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EC Official Assesses BRITE/EURAM Program

AN890127 Brussels IRDAC NEWS in English
Mar 89 pp 1-2

[Synopsis of a presentation by H. Tent, deputy director general of DG XII, the Directorate General for Science, Research, and Development of the EC Commission, at the BRITE/EURAM conference in Brussels, Belgium on 31 January: "Editorial: BRITE/EURAM Technological Days 1989"]

[Text] Now, as the BRITE/EURAM [Basic Research in Industrial Technologies for Europe/European Research on Advanced Materials] days are becoming a regular annual event, the Commission officials are beginning to feel like directors of a company, reporting to the annual meeting of the shareholders of the BRITE/EURAM enterprise!

Before giving you last year's results, I would like to summarise the main elements of the management of Community R&D programmes (with particular reference to BRITE/EURAM) being a vital part of their success. These elements are threefold:

I. Consultative Structures:

We must ensure that programmes respond to the needs of industry. While it is evidently the responsibility of industry to undertake R&D for its future requirements, the Commission has a role to play where it is signalled necessary, to overcome temporary bottlenecks and, where it can, provide the added value. It is only possible to receive the right signals if we have the right consultative structures. We are helped by various committees, in particular IRDAC [Industrial Research and Development Advisory Committee], and we get feedback from events such as BRITE/EURAM Days. We believe we have the right basic structure, but here is a continuing requirement to check that the structures have not become static—we must not lose the dynamic character.

II. Equal Opportunity

The potential participants must have the same chance to participate in the programme, being small or large, near or far from Brussels.

There are two important elements, relating to availability of information and the operation of the selection procedures.

• Information and assistance:

Much of this is delegated to the national and regional level, through industrial organisations, chambers of commerce, national governments, etc. The lessons in this are threefold.

—The Commission does not have sufficient staff to undertake these tasks.

—Information can be better directed at national level.

—The perception of Brussels bureaucracy needs to be taken into account.

The arrangements through the local contact persons work well, although we cannot claim to be perfect. Some Member States are better organised than others, but I know that the latter are working on improvements. It is important because there is a relationship between the quality of information at the national/regional level and the scale of programme participation and the number of successful projects.

It should not create the impression that the Commission is passive. Let me give you the following examples:

—Officials participate in meetings with Member States and have regular briefing meetings with contact persons.

—Information packages provide detailed conditions for participation.

—The "expressions of interest" service enables the development of a call for proposals to be assessed at an early stage and is particularly important in finding partners.

—We are always pleased to talk to you in Brussels. Direct contacts are refreshing and helpful.

• Selection procedures:

The selection procedures are characterised by confidentiality, speedy decisions and, in particular, a selection based on objective criteria. It is the responsibility of the Commission to ensure that projects are only selected on scientific, technological and economic criteria and not for other considerations. Therefore, we rely on the help of independent experts, for example, more than 100 participants at the last BRITE projects evaluation—they ensure that only excellent projects are accepted. This principle is a cornerstone of the programme, and the Commission will never finance projects not judged as excellent by independent experts.

III. Project Management

Project management of international projects is a fascinating subject from two aspects: between partners and between partners and the Commission.

We have a major responsibility to avoid unnecessary bureaucracy. Nevertheless, bureaucracy should not always be seen as bad, as we must ensure that the taxpayer's money is well spent, and it can be useful that Commission experts act as an "honest broker" to get a project off the ground.

A condition is that the Commission team be small, flexible, entrepreneurial and catalytic.

The challenge we face is that the previous BRITE/EURAM of ECU 200 million has now been replaced by one of ECU 500 million and so calls for a different management structure. New methods are being studied for Commission R&D management; the methods used will have to respond to the needs of the different programmes. It is too early to give the results; however, if we want to maintain a flexible management, this can only be assured if the "Brussels team" remains small and is assisted in a structural way by a network of high-quality experts from all Member States working part-time for the Commission and assisting in the technical monitoring.

Turning to the BRITE/EURAM programme itself, I would like to bring the following points forward:

• An independent panel under the chairmanship of Mr Farge carried out a very thorough evaluation of BRITE, working very hard over many weekends, for which we are most grateful.

• There are some very encouraging signs that come out of the evaluation panel's report.

—Eighty-five percent of the projects would never have happened without BRITE, and consequently large numbers of new alliances between industries and between industries and universities have come about.

—Industry participants are 67 percent of the total, achieving an industrially oriented programme. There has been an encouraging involvement from SMEs [small- and medium-sized enterprises].

—Eighty percent of the projects are already making progress and 60 percent confidently expect results within an optimistic five years.

We have succeeded in proposing a new BRITE/EURAM programme with a budget almost 2.5 times higher, which in the next few weeks will be approved by the Council of Ministers. A call for proposals with a closing date of 12 May is already launched. More details of this will be given by Mr Garcia Arroyo (who is in the driving seat for BRITE/EURAM and his team on the Proposers Day).

There are a number of new elements in BRITE/EURAM, many of them introduced as a result of comments from evaluators and from the participants.

• BRITE and EURAM have been integrated into a single programme in recognition of the considerable overlap.

• The present rejection rate is 1:5 or 6, which needs to be reduced. It should, however, be brought into proportion. The rejection rate of excellent projects is far less, although it is still too high: around 1 to 2.5. This should be helped by:

—An increased budget as foreseen for the new BRITE/EURAM programme (but which finally is not a solution in itself);

—More precise definition of priority themes;

—Annual calls for proposals;

—Further improvement in the expressions of interest (and so avoiding unnecessary expense on an inappropriate proposal);

—Improved selection procedures that may result from the study to be undertaken by a team of industrialists chaired by Mr Guasch, member of IRDAC, based on the recommendations of the evaluation panel.

We will be exploring how best we can improve the operation of the programme to avoid people going to the trouble and costs of preparing a proposal which is finally not supported.

• Help for SMEs through the Feasibility Awards. A first call for proposals has now been launched. Next year, I hope to report back on the results.

• Focussed fundamental research—to cover more basic research, particularly in the materials area, for work needed to enable subsequent applied research to go ahead. The fundamental research needs, however, to have an industrial purpose, and industrial backing of projects is required.

• Industrial pull: Industry is the major participant in the programme. The evaluation panel signalled in many sectors a lack of involvement with top management over the introduction of new technology in general and a lack of awareness that technology has to be seen as part of the company's total strategy.

BRITE/EURAM will demand of projects, therefore, that they be signed by the top management to be reasonably ensured that it is part of the company's strategy.

This brings me back to my starting point and the essence of the BRITE/EURAM programme, which is to help to increase the competitiveness of European industry. We must not sit back and be satisfied with the encouraging results obtained, but continually check if our activities are still reflecting the needs of industry, which by definition are dynamic. Manufacturing industry is important, providing 30 percent of GNP and 75 percent of the industrial workforce. Programmes like BRITE/EURAM are important. You are all the "stakeholders" in these initiatives.

AEROSPACE, CIVIL AVIATION

Aeritalia, Aermacchi, Fiar Sign Agreement for ASV Radar
MI890184 Rome AIR PRESS in Italian 3 Mar 89 p 394

[Text] Aeritalia and Aermacchi have signed an important cooperation agreement with Fiar for completion of the ASV (Antiship Variant) "Grifo" radar, which may be used on the AMX tactical support aircraft currently being delivered to the Italian and Brazilian air forces.

The know-how acquired in the sector has made it possible for Fiar to develop the new Grifo radar. The technology is based on the technology Fiar has proposed for the new EFA [European Fighter Aircraft] radar project; the EFA is the future aircraft for European air superiority. A press release sent to AIR PRESS highlights the fact that the upgrading of the autonomous operating capabilities of the AMX weapons system to defend against naval attack satisfies the latest requirements of many air forces interested in an aircraft designed for this type of mission. The AMX antiship version increases the export potential of this radar, in response to the growing interest expressed by a number of countries.

EC To Allocate 60 Million ECU for BRITE-EURAM Program
MI890182 Rome AIR PRESS in Italian 22 Feb 89 p 342

[Text] The European Community has allocated 60 million ECU (European Currency Unit; one ECU is equal to approximately 1,500 lire) to research in the field of aviation within the BRITE-EURAM program, which is concerned with manufacturing technologies and advanced materials. AIR PRESS reports that this statement was made by Italy's minister for research, Prof Antonio Ruberti, at a one-day meeting on this topic organized by the ministry at the headquarters of the CNR (National Research Council) on 22 February. Of the total amount allocated, about 20 million ECU invested in research for the production of high-tech materials for aeronautics, while the remaining 40 million will be allocated to five other fields in the aeronautics sector. The details of the program have not yet been finalized.

In his speech, Minister Ruberti invited the scientific and business communities to take advantage of this new opportunity offered by the EC to ensure adequate financial returns as well as the benefits that may derive from international cooperation in the advanced technology sectors. The minister pointed out that Italy also considers new materials to be a strategic sector, as shown by the fact that the CNR has undertaken a finalized project in this area. In addition, a national program is currently being studied which will be funded in accordance with the provisions of law no 46; this program should be finalized by next March.

FRG, Japan Join Efforts in Microgravity Research
MI890157 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 30 Nov 88 p 11

[Text] As a result of talks between German and Japanese scientific experts set up by the BMFT [FRG Ministry of Research and Technology] and the Japanese Ministry of Science (STA), an agreement on ten basic research projects was reached in Bonn at the end of October.

The common denominator of these joint projects in the physical and life sciences is their relevance to gravity and microgravity. The work will initially be done in laboratories on earth; each side will pay its own expenses. The individual projects are as follows:

I. Physical Sciences

I.1 Project MS 1/88: Instability in Fluid Configurations and Convection Currents Caused by G-Disturbance. Field: interface and transport phenomena, fluid physics. Dr M. Ishikawa, Mitsubishi Research Institute, Tokyo; Prof D. Langbein, Battelle Europe, Frankfurt.

I.2 Project MS 3/88: Marangoni Convection in Material Melting. Field: interface and transport phenomena, fluid physics. Prof A. Hirata, Waseda University, Tokyo; Dr Ch.H. Chun, DFVLR [German Aerospace Research and Experimental Facility Gottingen; Professor Siekmann, University of Essen.

I.3 Project MS 7/88: The Behavior of Markov Intervals [Markostufen] Under Microgravity Conditions. Field: crystals. Prof T. Nishinaga, University of Tokyo; Prof K.W. Benz, University of Freiburg.

I.4 Project MS 9/88: Boiling Processes Under Microgravity Conditions. Field: physical chemistry and process technology. Dr Y. Abe, Electronics Laboratory, Ibaraki; Prof J. Straub, Technical University of Munich.

I.5 Project MS 10/88: Droplet Combustion. Field: physical chemistry and process technology. Prof M. Kono, University of Tokyo; Dr T. Niioka, National Aerospace

Laboratory, Tokyo; Dr J. Sato, IHI Research Institute, Tokyo; Prof H.J. Rath, Applied Aerospace Technology and Microgravity Center (ZARM), University of Bremen.

1.6 Project MS 11/88: Study of the Elementary Chemical Kinetics Between Gaseous and Condensed Phases under Microgravity Conditions. Field: physical chemistry and process technology. Prof H. Matsui, University of Tokyo; Prof J. Troe, University of Gottingen.

II. Life Sciences

II.1 Project LS 1/88: Gravity-Sensitive Mechanisms in Plants and the Significance of Gravity for Growth and Development. Field: biology. Prof M. Yamada, University of Tokyo; Prof Y. Masuda, Osaka City University; Prof A. Sievers, University of Bonn.

II.2 Project LS 2/88: Gravity-Sensitive Mechanisms and Their Integration at Cellular and Subcellular Levels. Prof K. Tanahashi, University of Tokyo; Prof H. Machemer, Ruhr University, Bochum.

II.3 Project LS 3/88: Adaption of Gravity-Sensitive Mechanisms to Microgravity. Field: medicine. Prof S. Watanabe, Nagoya University; Prof R. von Baumgarten, University of Mainz.

II.4 Project LS 4/88: Cardiovascular System and Body Fluid Displacement Under Simulated Microgravity and Space Flight Conditions. Field: medicine. Prof N. Matsui, Nagoya University; Prof K. Kirsch, Free University of Berlin; Prof L. Rocker, Free University of Berlin.

Italy, France To Develop New Anti-Missile System

MI890161 Rome AIR PRESS in Italian
8 Feb 89 pp 238-240

[Text] The industrial agreement for the Aster program involving an anti-aircraft, anti-missile missile defense system will be signed by the end of the year. The agreement for this next-generation system follows up on the agreement of 27 October 1988 between the French and Italian governments which President Mitterand announced in Arles in 1987. AIR PRESS's correspondent writes that this was confirmed by officials of Aerospatiale and Thomson-CSF, the French prime contractors for this program (in Italy, this role is played by Selenia), during a guided tour of several plants in France organized by GIFAS (the association of the 142 French aerospace industries).

At present, the agreement is evenly balanced between Italy and France. However it was confirmed on this occasion that there are hopes that it will be widened to include other European nations—especially the FRG, which could participate through MBB.

Aster is the name of the missile employed in a system that was conceptually developed in France, such as SYRINX (rapid inter-weapon system based on engines functioning on X-rays). This should allow defense to adapt to new threats ranging from supersonic missiles (and/or final trajectory dive-bombing) with guidance systems that cannot be affected by ECM's [electronic counter measures] or even stealth systems, to submunitions dispensers and RPV's [remotely piloted vehicles]. The Franco-Italian agreement covers the combined development of an entire family of surface-to-air missile systems, essentially based on two tracks: for short distance defense (in this case, the system for naval use will be adapted to the special needs of each navy) and for medium distance defense (in this case, both the naval and the mobile land version should have the same structure in both countries). Early last year, the French defense minister assigned the first development contracts for the main subsystems, the missiles (Aerospatiale's Aster), and the firing control system (Thomson-CSF's Arabel).

The use of the word "family" here implies an ability to meet all requirements of the three armed forces, as well as the development of completely new subsystems in all areas: the missile, its radar, and the firing controls. Despite obvious difficulties, it has been possible to harmonize the working requirements to the point that this system has become an interforce system. It was clear right from the start that the entire program needed to acquire an international character in order to overcome the extremely high costs stemming from the demand for innovation in all fields.

On the other hand, AIR PRESS observes, this demand has already been felt. The IEPG (Independent European Planning Group) has been studying it; France, Italy, the FRG, the UK, the Netherlands, Norway, and Spain are all pushing to find a European successor to the Hawk land system. (The Aster solution will be examined shortly under this aspect). Simultaneously, the FAMS Group (Family of Anti-Air Missile Systems) has been launched; France, Italy, the UK, and Spain are taking part in this program. Italy and France are proposing to extend their own commitment within this initiative to cover all related requirements, including LAMS (Local Air Missile System). The other two nations in the group are promoting this as a surface-to-air weapon for NATO frigates in the NFR 90 program. The FRG and France have formally requested to be kept up-to-date on developments in this area.

The French Navy has decided to install the naval system on its first nuclear aircraft carrier, the Charles de Gaulle. It is predicted to be operational by 1995 or 1996. This will be the SAAM version, the least complex in the family, which uses the short-range Aster 15. The other two are a land and shipboard variation of the SAMP version, which uses the short-range Aster 30 missile. This should be operative by 1998. The ATBM system may be achieved in the future; this system is even more developed.

The Aster missile's most innovative feature, AIR PRESS reveals, is its guidance system. This has been studied by Aerospatiale to obtain a level of agility which is decidedly greater than that of the present generation of surface-to-air missiles. This is necessary to have any real effectiveness in fighting the air-to-ground weapons of the foreseeable future. This system has been given the acronym PIF-PAF: Pilotagen Forge, combined with Pilotage Aerodinamique Fort. While the latter is quite simply the conventional type of guidance system in which the adjective "fort" indicates that its task is to work on the other's error, the former involves control obtained through jets of hot gas emitted from nozzles placed near the missile's center of gravity, creating lateral acceleration. The combination of the two guidance systems provides the desired agility. The interception stage where munitions and aerodynamic guidance systems have been installed has already been tested. For the first stage, a currently existing booster was used instead of the definitive booster. This disparity in power will differentiate the Aster 15 from the Aster 30.

Although the French SAAM will use Thomson-CSF's Arabel radar, the Italian version calls for the EMPAR 4D radar (European Multi-Function Phased-Array Radar). Selenia is working on this in its own consortium which includes this French company and the UK company Marconi.

COMPUTERS

FRG Research Association Issues Final Report on Cybernetics Project
MI890150 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 16 Jan 89 pp 8-9

[Excerpt] After 14 years of funding by the German Research Association (DFG), the special research program on cybernetics set up at the Munich Technical University and the Max Planck Institute for Behavioral Physiology in Seewiesen has submitted its results. The Munich scientists provide information on the most important results of their work in the fifth volume of the DFG publication, "Special Research Programs."[passage omitted]

The DFG provided the cybernetics research program with approximately DM22 million in subsidies; approximately 98 scientists were involved in the program. The final report, "Processing Structures for Perception and Action—Results of the Special Research Program on Cybernetics at the Technical University and the University of Munich and at the Max Planck Institute, Seewiesen", edited by Hans Marko, Gerd Hauske, and Albrecht Struppler (1988, 278 pages, paperback, DM98), can be obtained from VCH Verlagsgesellschaft, Postfach 1260/1280, 6940 Weinheim.

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NUCLEAR ENGINEERING

Joint FRG-USSR Research on Germanium Neutrino Mass
MI890151 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 16 Jan 89 p 9

[Excerpts] In early December 1988, FRG and Soviet physicists signed an agreement on an important joint experiment to investigate neutrino masses. [passage omitted]

One interesting concept is based on the characterization of the double beta decay, in which two neutrons are transformed simultaneously into protons inside an atomic nucleus. This is an extremely rare process. Particularly favorable conditions have emerged for a joint FRG-Soviet project to identify double beta decay in the germanium 76 isotope. The USSR is the only country to possess the necessary quantity of strongly enriched germanium 76. This material is very valuable because it is costly to produce. The Soviet project partner is the Kurchatov Institute of Atomic Energy in Moscow.

On the FRG side, the Max Planck Institute of Nuclear Physics in Heidelberg provides the theoretical knowledge of double beta decay, as well as practical experience in developing disturbance-free detectors and the required high precision measuring equipment. This project can only be tackled by combining the specific contributions of the two countries.

In early December the first 7.5 kg of the valuable germanium isotope were delivered to Heidelberg. Work on the project can now begin.

SCIENCE & TECHNOLOGY POLICY

EC Approves Italian Refinancing of Research Assistance
MI890176 Rome AIR PRESS in Italian 3 Feb 89 p 176

[Text] On 1 February, the European Commission approved Italy's decision to refinance an aid program for applied research by 1.5 trillion lire over the period 1988-89. According to Commission sources, the special fund for applied research is the primary instrument in Italy for providing financial assistance to industrial research projects. Ninety percent of the fund encourages applied research projects, especially in the sector of electronics, as well as projects that potentially complement the EC's research and development policy and major Community programs such as ESPRIT for computer science, RACE for telecommunications, etc.

The Commission also approved new conditions for financing when it gave the go-ahead for the Italian research assistance program: beginning this year, the level of aid per project will decrease substantially. For companies in the north and center of Italy, it will drop

from 40.4 percent to 31.7 percent of investments. For small- and medium sized companies and companies in the south of Italy, it will drop from 46.3 percent to 37.6 percent. Furthermore, only those companies with less than 100 employees and a volume of business under 5 million ECU, approximately 7.5 billion lire, will be considered in this category. Finally, the Commission decided that loans for projects over 10 billion lire provided by IMI [Italian Institute for Financing Personal and Real Property] from its own funds may receive grants comparable to those provided for loans from the special fund for applied research.

BIOTECHNOLOGY

GDR: Firm Establishes Pilot Plant for RNA

23020021 Leipzig CHEMISCHE TECHNIK in German No 10, 1988 pp 423-434

[Article by Volker Eckart[1], Dieter Cech (2), Klaus Kammel, KDT (1), and Joachim Bauch (1): "The Preparation of Laboratory, Bio- and Fine Chemicals in the VEB Petrochemical Combine Schwedt, Part III: Ribonucleic Acid and RNA Components"; Contribution from the VEB Petrochemical Combine Schwedt, Parent Company, Research and Development Directorate (1), and the Humboldt University of Berlin, Chemistry Section (2)]

[Text]With the expansion of knowledge in the technical areas of biotechnology, genetic engineering, molecular biology, and medicine, a rapidly growing need has arisen for a large number of special chemicals. This development has been noted by famous manufacturers of laboratory and bio-chemicals, who have expanded their production programs step-by-step and adapted them to the needs of modern biochemical working methods and synthesis methods. In the area of laboratory and fine biological chemicals, about 20 firms are now well established on the world market.

The parent enterprise of the VEB PCK (Petrochemical Combine) Schwedt for years has been assigning major significance to the development of fine laboratory chemicals, as a measure towards the greater refinement of available raw materials. To expand the spectrum of laboratory and fine bio-chemicals, basic research on the preparation of ribonucleic acid and ribonucleic acid components has been performed since 1986. The previously customary nucleic acid resources were not supposed to serve as the starting materials here, instead, Candida yeasts, cultivated on petroleum distillate were used. Research production for the following classes of compounds is planned:

Ribonucleic acid (RNA)
Ribonucleotides
Ribonucleosides
Ribonucleases.

Possibilities for Application

Fine bio-chemicals are frequently produced for a large group of users who, however, need only small amounts of these materials. The market here is distinguished by a relatively stable demand.

The application possibilities of private groups that are presently in the development stage or will be so in the future are numerous. They make it possible to produce high-grade final products, secure the economic effectiveness of the final products, and make refinement processes possible. Nucleic acid and nucleic acid components have the character of qualitatively high-grade top products and they are the result of a high level of refinement of the starting materials. Table 1 provides an outline of the manifold application possibilities of these products.

Table 1: Application Possibilities of RNA and RNA Components (Selection)

Product	Application
Ribonucleic Acid	Diagnostic products in medicine, reference substances, calibration substance
3'(2')-monoribonucleotide	Basic material for pharmaceuticals, reference and calibration substance
5'-monoribonucleotide	Components for the chemical synthesis of RNA segments or mixed DNA/RNA segments, basic material for pharmaceuticals (rheumatic and cardiac-vascular agents, additive to blood stabilizers, flavor enhancer)
Ribonucleoside	
-Adenosine	Pharmaceuticals for blood pressure, arterial sclerosis, angina pectoris, ATP production, nucleoside antibiotics
-Cytidine	Mycostatic, as fluorine derivative to treat leukemia
-Uridine	As fluorine derivative for chemotherapy of cancer diseases
Ribonucleo bases	
-Adenine	Pharmaceutical for coronary therapy
-Cytosine	Arabinoside against leukemia
-Uracil	As fluorine derivative for pharmaceuticals. As bromine derivative for mutagenesis

Isolation of RNA and RNA Components

In the first working step, the isolation of RNA from feed yeast was studied, as well as its splitting into 3'(2')-monoribonucleotides.

Isolating RNA

The total RNA content of each cell differs from species to species. It depends in particular on growth and functional conditions, but also on the age of the cell. Cells which are characterized by active protein synthesis have the highest RNA content, while cells whose function is not associated with particularly conspicuous protein synthesis exhibit only a low RNA concentration. Table 2 gives a selection of values for the RNA content in micro-organisms.

Table 2. RNA Content in Various Micro-Organisms (% of TS) [1]

Organisms	C-Source	NA Content (in %)
Methylophilus methylotrophus	MeOH	15.9
Cellumonas	Cellulose	28.0
Candida utilis	Sugar	7.8
Yeast sp.	n KW	up to 11.0
Tricosporum polluans	Gas Oil	5.23
Candida scottii	Naphtha	7.1
Baker's yeast		3.95 [2]
Viruses		
—Tobacco Ring Flat		400
—Poliomyelitis		25
—Phage MS 2		31

The various nucleic acid types (DNA, RNA) have a characteristic intra- cellular localization, which is closely related to their function. In micro-organisms, the RNA is distributed among several cell functions:

—t-RNA in the soluble cytoplasm
—in the ribosomes, protein-bound ribosomal r-RNA
—m-RNA organized in the polysomes.

In the E-coli cells, the ratio r-RNA/t-RNA/m-RNA is approximately 80/15/1. In absolute terms, about 10,000 r-RNA molecules and about 2500 molecules of each AMS-specific t-RNA type are present in each cell under normal growth conditions [3].

In preparing nucleic acids, one must take into account that these occur in the cells, primarily not in a free state but bound to protein as nucleo- proteides. The isolation process required four steps:
1. Extraction of the nucleo-proteides
2. Splitting the nucleo-proteides and denaturing the proteins
3. Precipitation of the RNA
4. Preparation of the RNA preparations

The basic presupposition is the lysis of the cell, which can be accomplished by various methods mechanically, chemically, or biologically. To change the stability of the yeast cell wall, one generally still works with alkalis, MeOH-NH$_3$ salt or phenol and other solvents. However, due to the instability of the phosphoric acid ester bonds, the lysis methods entail the risk of already splitting a portion of the RNA into fragments with a low molecular weight. When lysing the cell, the pH value, the ion concentration, and the working temperature must be chosen so that degradation of the RNA is largely prevented.

This manifold task could be accomplished only by the interdisciplinary collaboration of chemists, process engineers, and in virtue of the fact that the scientific cooperation between the PKC and the Chemistry Section of Humboldt University, Berlin, as well as the employment of a youth research collective could be utilized fully.

The preparation of RNA from feed yeast requires especially adapted lysis methods. Methods to reduce the nucleic acid content in yeast can be found in the literature. Starting with these methods, the following lysis procedures were investigated in detail under laboratory and pilot plant conditions:

-Salt lysis with 10 % (NH$_4$)$_2$SO$_4$ solution	1
-Alkaline lysis with 5 N NaOH	2
-Lysis with MeOH and NH$_3$ gas	3
-Lysis with previous lipid extraction by a mixture of MeOH-chloroform	4
-The use of liquid nitrogen	5
-Aqueous lysis	6

The results are presented, by way of excerpts, in Table 3.

Table 3. Studies on the Lysis of Feed Yeast

Lysis Methods[1]		1	2	3	4	5	6
Proportion of RNA in the starting yeast	%	8.0	8.0	8.0	8.0	8.0	8.0
Isolated RNA Quantity	(in kg)	2.3	2.5; 2.0	1.2	1.1	2.4	1.35
Purity	%	77.2	61.2; 44.0	41.2	68.0	63.5	68.0
RNA Amount 100 %	(in kg)	1.8	1.6; 0.9	0.8	0.75	1.5	0.9
Yield, relative to RNA	%	45	40; 22.9	20	18.8	37.5	22.5
to HTS	%	3.6	3.2; 1.8	1.6	1.5	3.0	3.0
Proportion of RNA in the treated yeast	%	2.6	2.4; 2.4	4.2	2.8	2.9	4.2
Proportion of RNA in the lysis solutions after precipitation	%	1.4	2.4; 3.4	2.0	2.2	1.4	2.2
Results of the RNA balance	%	7.6	8.9; 7.6	7.8	6.5	7.3	8.2

[1]For lysis methods 1 through 6, see text "Isolation of RNA."

For isolated RNA, the following use-value parameters are achieved (expert opinion from Humboldt University, Berlin):

—Purity 80...95%
—Phosphorus content 7...9%
—Moisture less than 10%
—Stable at room temperature
—Can easily be split into components.

Preparation of 3'(2')-Monoribonucleotides

The technical literature contains a large number of publications on the degradation of RNA [4]. The reactions can be chemical but also enzymatic, where the following degradation paths are possible, among others. The fission product models here depend on the choice of degradation path:

Alkaline splitting
—————————>   3'(2')-monoribo-
NaOH   nucleotide

Alkaline splitting
—————————>   Ribonucleoside
$Ca(OH)_2$

RNA

Enzymatic splitting
—————————>   5'-monoribo-
     nucleotide

Acid splitting
—————————>   Ribonucleo-bases
HCl

The fission products are separated by preparative chromatography on ion exchangers.

Pilot Plant Facility (Multi-Product Facility)

One objective of research and development is to make possible research production already in the stage of basic investigations. Because of this, the construction of a small pilot plant was indispensible. The point is to test information from laboratory experiments immediately under production-proximate conditions. For this reason, the pilot plant was planned and implemented in such a fashion that the product spectrum could be made variable as regards the products, quantities, and qualities, could be refined step by step, and could be adapted to the advancing state of knowledge. The following process steps were worked on:

First stage
—Lysis of feed yeast
—Precipitation of RNA
—Purification of RNA

Second stage

—Fissioning the RNA

—Chromatographic separation of the fission products

—Purifying the fission products

—Finishing

—Effective processing of the incident by-products.

Figure 1 [not reproduced] shows a simplified engineering diagram of the facility.

As regards the individual apparatus, the facility has a relatively uncomplicated structure. The most notable pieces of equipment are the following:

—agitating apparatus to achieve material conversion and storage processes

—centrifuges, membrane filtration and separators for separation processes

—receivers and measurement containers

—preparative chromatography (in preparation)

—distillation equipment,

A significant portion of the equipment is made of glass.

The pilot plant facility implements the following tasks among others:

—trying out the basic technical solutions

—producing product samples for analytical and applications purposes

—materials testing

—investigation of process engineering relationships

—gathering information about characteristic process and equipment variables

—safety parameters (degree of risk for fire and explosion).

After a preparatory and implementation time lasting only 11 months, the first expansion stage of the nucleic acid technical facility could be approved for trial operation on 18 December 1987.

Requirements were determined in close collaboration with various ministries and foreign trade. The scientific-technical requirements for development and the production of special products frequently exceeded significantly the average production process. The high-grade work expended naturally also justifies the claim for a high economic result as compared to average production.

After completion of the complete pilot plant facility,

—the demand for ribonucleic acid in the GDR can be covered as of 1988
—research production of 3'-(2')-monoribonucleotides can begin in 1989
—research production of ribonucleosides and ribonucleo-bases can be implemented after 1990, their demand in the GDR can be covered, and such products can possibly be exported.

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Received on 18 April 1988.

Footnotes

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COMPUTERS

Hungarian Movement, Angle Data Transmitter Interface Developed

[Article by Gyula Mentes: "An Intelligent Movement and Angle Data Transmitter Interface"]

[Text] The article describes a unit, made with a microprocessor, which evaluates the signals of movement and angle data transmitters and which makes it possible to connect several transmitters to one computer. The device can be programmed to suit the needs of the user, thus relieving the burden on the connecting computer to a large degree. The intelligent interface described can be used well to solve various regulating and control technology tasks. The example given is for coordinate measurement and processing in the case of an instrument to evaluate stereo aerial photographs.

Introduction

Linear movement sensors and angle data transmitters are frequently used to sense movement and angle changes in measurement technology. Several are often used at one time to solve more complex measurement tasks. Now, in virtually every case, we process our measurement results with a computer or automatically intervene, with the aid of a computer, in some process for purposes of regulation or control depending on the signal of the angle data transmitter. We developed an intelligent interface at the Geodetic and Geophysics Research Institute of the MTA [Hungarian Academy of Sciences] in Sopron in order to facilitate the linking of the computer and the movement or angle data transmitters and in order to simplify operation.

Structure of the Intelligent Movement and Angle Data Transmitter Interface

The device is essentially a microcomputer with a unique structure, a block diagram of which can be seen in Figure 1. The circuit units needed to realize the several functions are placed on individual cards. The cards are connected to a bus system consisting of eight data lines, sixteen address lines and r/W, Rd, Wr, e, E, IRQ, NMI, vma, ba, reset and RESET control lines. [Note: The control line designations are in all caps in the original; the capital letters here indicate those letters which had a bar over them in the original.] The several cards have their own address decoders which can be set. This structure makes it possible to develop a system which best suits the current needs of the user using the card assortment available to us.

Operation of the device is controlled by a control card built with an MC 7802 microprocessor; it contains the data and address bus circuits and the circuits needed to drive the control lines. There is room on the card for 12 K bytes of memory where one can put 2 and 4 K byte RAM and ROM capsules for data and program storage. In our case the operating program is located in a 4 K byte capacity UV EPROM and we use a 2 K byte capacity HM 6116 RAM for data storage.

Two sorts of cards are used to connect the movement and angle data transmitters. The incremental transmitters, the output signal of which is two square pulse sequences shifted in phase by 90 degrees to one another, can be connected to the counter cards. The signals of the transmitters are received at the inputs of the cards by matching and Schmitt-trigger pulse forming stages; the signals go through a direction-decision circuit to the input of the counting stage. Counting is done in BCD code, the counter having a length of six digits. If a longer chain is needed then two counter cards can be connected in series. If necessary binary counters can be built onto the cards also without changing the cards. The counter outputs are connected to the system bus through stores with a three-state output. This makes it possible to read

out several counters at the same time despite the fact that the microprocessor reads the values of the counters from the stores one after another in time by byte (two BCD digits).

An address decoder can be found on every card. Addresses A_9 through A_2 are given by the control card; together with the authorization signal produced by decoding the A_{15} through A_{13} signals they serve to select the card; addresses A_1 through A_0 serve to address the latches which can be found on the card. The address decoder is so made that it is possible to erase all the counter cards connected to the system at one time and store the values of all counters at the same moment, but it is also possible to erase and store the individual counters separately.

We have developed parallel storage cards with 48 inputs to receive the signals of movement and angle data transmitters with coded output. As with the preceding cards the values of the counters are written into memory as a result of one pulse and the processor can take them out of memory in sequence. The address coding of the card is similar to the above with the difference that addressing the latches is done with the aid of A_2 through A_0.

The interface has an LED readout for direct display of measured values, initial values and identifiers and it has a keyboard to put in initial values, identifiers and instructions. The keyboard and readout interface card manages both the LED readout and the keyboard. This makes it possible to manage the keyboard, with the entire ASCII character set, the 16 digit, seven segment readout and the indicating LED's. In the basic arrangement we use a six digit readout on which the values of the counters can be displayed one after another. If more cards are used every counter can have a readout. Connection to the computer is made possible by an RS 232C serial or Centronics parallel interface.

The functions of the intelligent movement and angle data transmitter interface are:

1. Indicating the Values of the Counters

There is one readout in the basic arrangement. The counter to be read out can be selected with pushbuttons on the front panel. An LED lighting up by the pushbutton indicates which counter is being read out.

2. Erasing Counters One By One

The counter selected by the pushbutton can be zeroed out with the RESET button found on the front panel.

3. Giving Initial Values to the Counters

In the case of one readout putting in or erasing the initial value can always be done only for the indicated counter. In the case of several readouts the initial value can be

written into the previously selected counter. Summing the initial value and the content of the counter is done by software when querying the counter.

4. Setting Counting Direction

Setting the counting direction is done separately for every counter with a pushbutton on the front panel. An LED indicates the direction set.

5. Selecting Counters

With pushbuttons found on the front panel one can select those counters, or those movement or angle data transmitters, which are needed in the given measurement process and the values of which will go into the computer. An LED indicates the selected counters.

6. Putting In or Displaying the Measurement Indentifier Number

The identifier number is put in from the numeric keyboard located under the readout when we have selected the display of the identifier with a pushbutton on the front panel. It is possible for us to assign one identifier number to every counter.

7. Automatic Increasing or Decreasing of the Measurement Identifier Number

This can be selected with pushbuttons. An LED indicates the operating mode. After every processing of the value of the assigned counter the value of the identifier number is increased or decreased by one in accordance with the mode chosen.

8. Generating a Break for a Given Counter Content

If a counter reaches a value set in advance through the keyboard or by the connecting computer then the intelligent interface sends a signal to the computer.

9. The START Button on the Front Panel

This transfers the values of the selected counters and the corresponding measurement identifier numbers to the computer.

10. Polling by the Computer

This transfers the values of the selected counters and identifiers to the computer.

11. Power Supply

Provides power to the connecting movement and angle data transmitters (optional).

Factors in Developing the System

1. Modular structure, expandable as desired.

2. Can be connected to any computer as desired.

3. Relieving the burden on the connecting computer in the most rational way possible. This is especially essential when using low speed computers or computer applications (e.g., personal computers programmed in BASIC).

4. A possibility for checking operation of the angle data transmitters independent of the computer.

5. An independent use possibility for simpler tasks (e.g., direct readout of measured values or writing them to a printer).

Applications Possibilities for the Intelligent Movement and Angle Data Transmitter Interface

The interface can be used well in every case where we want to measure one or more movements or angle movements with linear movement transmitters or angle data transmitters. Such tasks arise, for example, in machine tool control, for coordinate and drawing boards and in other measurement and control technology tasks. The transmitters which can be connected can have incremental or coded output. There is one interface card for every transmitter.

In the case of a coded transmitter two transmitters can also be connected to one card, up to 6 digits. Theoretically the number of interface cards is limited by the address range of the interface system, but in practice the number is limited by the processing speed needed and how much the bus of the system can be loaded. The independent functions relieve the burden on the processing computer. It is also possible to build in additional user oriented programs (e.g., adding or subtacting the signals of the angle data transmitters or doing special calculations).

At our institute we use the intelligent movement and angle data transmitter interface with a Stecometer C stereo aerial photograph evaluating instrument made by Jena-Zeiss. The task is to sense the movement of the x and y coordinate and p_x and p_y parallax measurement screws of the Stecometer and measure the coordinates with a precision of one micron with the aid of the built in incremental angle data transmitters made by Zeiss. Figure 2 shows the intelligent interface built for this purpose.

There is a six digit readout on the front panel to indicate the four counters and the measurement point identifier numbers. The value of the content of any counter or the point identifier number can be displayed here. Selection of the value to be displayed is done with the pushbuttons arranged in a vertical column to the right side of the readout. A light emitting diode beside the pushbutton indicates which value the readout is displaying. Using the pushbuttons located in the next column one can select whether the counter belonging to the button will

count forward or backward or, as a result of pushing the START button, the content of which counters will be written into the connecting computer. The intial value of the counters and the measurement point identifier number can be set with pushbuttons located under the readout with the aid of the SET and RESET buttons. The measurement point identifier can also be put in with a manual keyboard located on the Stecometer and erroneous point numbers can be erased and rewritten. We connected a Commodore 64 personal computer to an RS 232C interface channel. Preprocessing of the measured values is done on the Commodore 64 but full evaluation, producing the terrain coordinates and drawing the maps is done on an HP 1000 computer (Figure 3).

Figure Captions

1. p 30. Structure of the intelligent movement and angle data transmitter interface [block diagram].

2. p 31. The angle data transmitter interface made for the Stecometer C stereo aerial photograph evaluation instrument [photograph].

3. p 31. The aerial photograph evaluation system [block diagram].

GDR: New Software Package for Synthetic Chemistry Developed
23020059 East Berlin WOCHENPOST in German of 17 Mar 89

[Editorial Report] East Berlin WOCHENPOST in German of 17 Mar 89 reports that Drs Rainer Moll and Uwe Lindner, respectively section and division chief at the GDR's Bitterfeld Chemical Combine, are currently heading up a project group tasked with developing computer applications for use in the search for new chemical substances or effective reaction sequences for producing specific products—a definitive step toward the application of CAD/CAM techniques in the chemical industry.

In line with that project, the Bitterfeld Combine, in collaboration with the GDR Academy of Sciences and other partners, recently developed a software package called Reaction Design by Synthon Substitution (RDSS). The latest versions of RDSS are currently undergoing the final phases of testing and refinement. The RDSS programming system, which can operate on 16-bit graphics-capable personal computers, has stimulated considerable interest both at home and abroad.

The RDSS software package can be used in three different ways for devising useful reaction sequences for chemical products:

a) Retrosynthesis

Here, a target chemical structure is proposed. Using the RDSS software, the computer then searches a chemical reactions database for suitable precursor compounds. By using color-coded reactive groups, called synthons, represented in the structural formula of the proposed target compound and displayed on a CRT, the computer breaks the target compound down, step by step, into simpler compounds. This technique operates much faster than conventional methods and can, from time to time, lead to reaction sequences which are entirely new inputs for specialists in the chemical field.

b) Reaction Prediction

This method begins with a raw material. The computer then uses the RDSS software to simulate what could be generated from that raw material. This is particularly practical when useful by-products are to be further processed using other techniques. Since all the by-products of a modeling operation are given as well, one can recognize that particular reaction which most dramatically transforms the starting material.

c) Bilateral Sequence

This is essentially a combination of retrosynthesis and reaction prediction. This method is particularly applicable when a target compound is to be generated from constituents already available but where a suitable reaction sequence is not known. Here, the software package lets the breakdown of a given end product and the possible reactions for producing a given starting material run concurrently. These processes are viewed on a CRT and are tracked by means of the superimposed reaction trees that are generated. When the reaction trees coincide, the chemist can recognize possible modes of chemical synthesis, called reaction paths, which could be of value in future synthesis operations.

The forerunner of the new software package has been in routine operation in Bitterfeld for at least three years. Both the old and the new software systems are constituents of a project called Computer-assisted Synthesis and Applications Research (Ger., CASAF), which had its roots in the'70s. As an example, Dr Moll cited that, in research involving plant protective substances, for arriving at a single effective and economically useful substance, 10,000 new compounds have to be synthesized and tested as thoroughly as possible in terms of their biological efficacy, environmental compatibility and so forth. Using conventional methods, that could take 10-15 years. The CASAF project should make a significant contribution toward more effective management of such research.

The diversity of compounds synthesized and studied heretofore has been well documented. At present, data on nearly 90,000 compounds exist in electronic form, covering aspects such as chemical and physical properties, test results and other findings. Apart from the database, nearly ten years ago, the Bitterfeld Chemical Combine introduced specific mathematical techniques making possible quantitative analyses with regard to the action of specified chemical structures. These building blocks also constitute part of CASAF.

Presently, the group headed by Drs Moll and Lindner, together with specialists from the Central Institute for Cybernetics and Information Processes and other entities, is working on a pilot project for CASAF II. This latter project will involve the application of artificial intelligence (AI) methods in synthetic chemistry.

GDR's A5120 Computer Used for Image Processing
23020047 East Berlin RADIO FERNSEHEN ELEKTRONIK in German No 12, 1988 pp 803-804

[Article by Dr Lutz Arnold and Peter Fisch of the Information Technology Section of the Technical University of Karl-Marx-Stadt: "Simple Multicomputer System for Image Processing"; first paragraph is introduction]

[Text] A multicomputer system is presented that offers the user a high level of computer performance and can be configured for various problem applications. The A5120 office computer, connected to the respective 16-bit computers via three-port memory, functions as the control computer.

For applications in the area of image processing, there has been a need for a computer system with the following properties:

- Its capacity should be adjusted to the volume of data used in image processing, the frequently complex algorithms and the special demands with respect to processing time.
- The system should not be tailored to one special application; rather, it should allow experimentation and the development of algorithms and/or be adaptable to various applications.
- The peripheral equipment must include both the image peripheral for input, output and storage of images, and the console and mass memory.
- If possible, existing OEM components and computers should be used. Even in developing operating software, the use of existing components was important. With all the necessary properties, the system should be a good value, and should not expand beyond the technical framework of a personal computer.

System Overview

The control computer for the multicomputer system is the A4120 office computer, on which the main part of the necessary operating and development software is
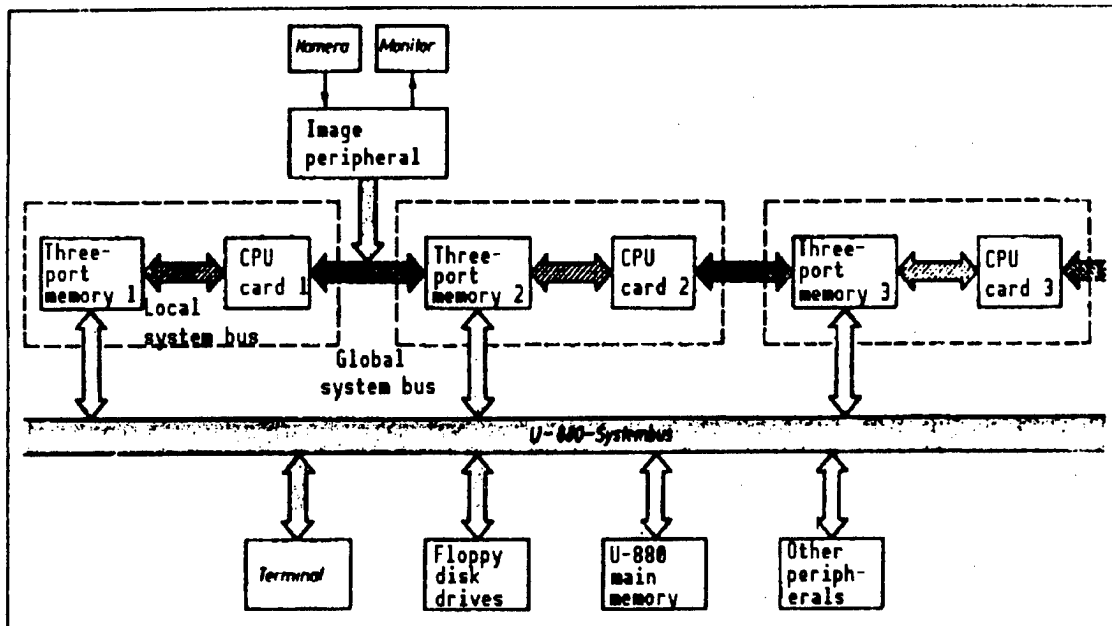
Figure 1. System Overview.

implemented. It works with a series of 16-bit computers that represent the greater part of the processing capacity realized by the overall system. Figure 1 shows an overview.

CCU cards from the USS 800 system were used as 16-bit modules (1) (2). For this, it is necessary to name only the most important parameters:

- U 8001 processor, 4 MHz cycle
- 2-Kbyte SRAM, 4-Kbyte EPROM, SIO, CTC
- Two separate bus couplings for the local 16-bit system bus (LSS) and the global 16-bit system bus (GSS).

In order to establish an effective connection between the processors, a three-port memory unit was developed. The image peripheral was linked to one of the 16-bit processors in order to make access to the image data sufficiently fast. It has the following technical characteristics:

- Resolution: 448 x 576 points
- Quantization: 6 bit/pixel
- CCITT television standard, synchronization internal or through camera
- Separate memory and choice of depiction of two half-images.

Three-Port Memory

The three-port memory was developed specially for this multicomputer system. Each port links two adjacent 16-bit processors. In addition, it handles coupling with the 8-bit computer. To this end, it has a memory

capacity of 32 Kbytes. Furthermore, it makes possible an equitable allocation of access and interrupt communication between the 8-bit computer and the respective 16-bit computer connected via the local system bus.

When memory is requested simultaneously by two or three processors, access is allocated randomly. The request from the 16-bit computer is decoded from the signals of the memory cycle and subsequently decided on for only one machine cycle. This ensures very short delays. On the part of the 8-bit computer, the memory is divided into four segments, which can be inserted as 8-Kbyte windows in the main memory area.

The computer linked to the memory via the local system bus can also be controlled by way of RESET, NMI and NVI. In the opposite direction, four interrupt sources are installed for the 8-bit computer via the CTC. This is important to ensure a corresponding debugging of the system and of the implemented processing software.

Text System

The core of the debugger on the part of the 16-bit computer is the RMON 8000 monitor implemented on the CPU card, which was expanded with commands for serving the image peripheral and with routines for communication with the control computer. In this way, it is still possible to use the debugger on the level of a single 16-bit computer (3).

The focal point for running the multicomputer system is the control computer. The debugger installed here running under UDOS performs the following functions:
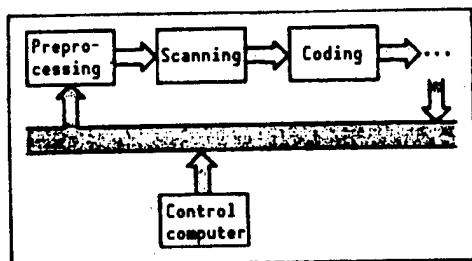
Figure 2. Example of a Pipeline-Type Processing Structure.

- Loading the programs for the 16-bit computer
- Starting one or several processing computers
- Interrupting the program run at defined check points with and without stoppage of the other processors
- Display field for information on program flow, start and break address, current program status for every 16-bit computer.

Through the operating software, an interface is created so that the monitor connected to a 16-bit computer can also be operated from the control computer.

Configuration

Coupling the individual components of the multicomputer system using the three-port memory makes possible various configurations of the processing system, depending on the application.

Pipelining (Figure 2)

Each processor works with one phase of the total algorithm and passes the processed data along to the next processor. This type of structure is very frequently needed in image processing. This configuration also corresponds to the most preferred use of the system, since the close link between the processors is used here and efficient data transport is thus possible. One special characteristic is the distribution of the bus, so that the processors do not get in each other's way.

In the example depicted in the figure, the data are fed into the chain by the control computer and the results are in turn accepted. In the event of exclusive access to the image peripheral, the control computer drops out of the processing sequence entirely and in that case has only an initialization function.

Parallel Work (Figure 3)

Here, all the processors are working on the same algorithm. The control computer is then indispensible to management of the input and output data.
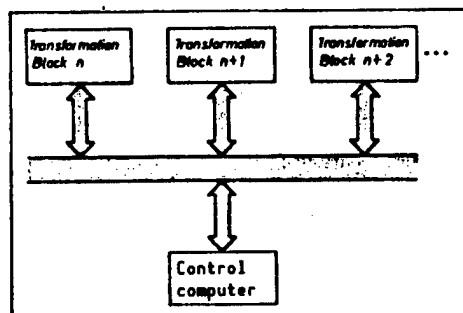
Figure 3. Example of an Independent Processing Structure.

Because of the large share of the 8-bit computer and of the centralized data flow, this configuration makes sense only if the data flow to be managed is small relative to the total processing effort. A good example is the linear transformation of images by blocks.

Besides the configurations depicted, mixed forms—several independent processor chains in a larger system layout—are also possible.

Based on this explanation, this system have applications other than image processing, since the configuration is easily adaptable to other processing tasks at any time.

Summary

A multicomputer system has been developed that fits in an office computer casing with three 16-bit processors, including an image peripheral. Its capacity exceeds that of 16-bit personal computers. A proven disadvantage of this machine as a development system is the relatively slow software generation for the U 800 via the cross software tools under UDOS.

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FACTORY AUTOMATION, ROBOTICS

Hungarian Version of AutoCAD Prepared
25020238 Budapest COMPUTER WORLD/
SZAMITASTECHNIKA in Hungarian 18 Feb 89 p 1

[Article by Szilard Szabo: "AutoCAD in Hungarian"]

[Text] It is good news for domestic CAD/CAM users that a Hungarian version of AutoCAD Release 10 is being prepared. The "naturalization" means not only that hereafter the text on technical drawings can also contain accented characters but also that Hungarian language commands and a Hungarian keyboard can be used during editing.

The Autodesk firm has entrusted the Oktatrend Small Cooperative with preparation of a Hungarian language AutoCAD. This small cooperative was the first vendor of AutoCAD in Hungary; a year and a half ago it got limited retail rights and it got unlimited retail vendor rights on 1 December of last year. (But it did not get exclusive rights, because Instrument Technology and Cosy have the same authorization.) They also sell the software package in other socialist countries—Czechoslovakia, Poland and the Soviet Union in addition to Hungary.

Oktatrend created an independent work group to develop the Hungarian version. And they are also making use of the professional aid of Cosy and of the Innova-CAD Office of the Instrument Technology Small Cooperative. The London center of Autodesk made available to Oktatrend the GML editing system. Commissioning the development also means that they will also sell every later version in the Hungarian language. (This is a noteworthy announcement because so far a new version has appeared every year.)

Today AutoCAD rules more than half of the world market for engineering design systems. Tamas Bakos, president of Oktatrend, feels that the success of the system can be attributed to its services, the ample professional literature, the continual product development and the flexible price policy of Autodesk. "There may be a better system than AutoCAD but it is not so widespread. It is very important for the customer to be able to connect his work to auxiliary descriptions, professional materials and developmental results, and we have nothing to complain of in this regard in the case of AutoCAD. Every buyer will get the newer versions free of charge for two years. Its price position is favorable and in addition various concessions can be made use of," he said in summarizing the advantages of AutoCAD.

Oktatrend, formed in April 1987 and having 20 members, does a hundred million in trade per year. They deliver special CAD/CAM tools in addition to software. They intend to strengthen their market position hereafter primarily in an indirect way—by founding mixed enterprises and joint stock companies. They want to remain "small" and feel that they can attribute their success to this. So far they have sold 40 copies of AutoCAD. Their customers include Iparterv [Industrial and Agricultural Designing Enterprise], Uvaterv [Road and Railroad Designing Enterprise], Agrober [Agricultural Designing and Investment Enterprise] and the Hajdu-Bihar County State Construction Industry Enterprise, all cited as reference locations. They have found very good receptivity in Debrecen, for example.

In the near future they will set up an AutoCAD training center at the Budapest Technical University which can be attended free of charge by students and those participating in post-graduate training; enterprises can make use of it at a favorable price. They would like to offer here training at such a high level that in time Autodesk London will recognize the BME [Budapest Technical University] AutoCAD Laboratory as one of its official training centers.

Czechoslovak Complex Automation Programs for Engineering Enterprises Described
24020021 Prague MECHANIZACE A
AUTOMATIZACE ADMINISTRATIVY in Czech
No 2, 1989 pp 54-58

[Article by engineer Milan Rabiska, candidate of sciences, deputy director of the Engineering Technology and Economics Research Institute, Prague: "Programs for the Comprehensive Automation of Czechoslovak Engineering Enterprises"]

[Text] Comprehensive automation of engineering enterprises and plants through the form of solutions for, experimental verification of, and repeated realization of exemplary highly automated production organisms at plant and enterprise levels is becoming one of the intensification strategies of the Federal Ministry of Metallurgy, Engineering, and the Electrotechnical Industry. In addition to the automation of material elements (production technologies, manipulation devices, etc.), an important role in comprehensive automation is played by the automation of nonmaterial elements and processes. Of these, the most important element is the system of management, since it is the integrating factor pertaining to the other material and nonmaterial elements of comprehensive automation.

The experiences of developed world firms demonstrate that the importance of nonmaterial elements, in comparison to material elements, is growing; the ratio between the costs of programs and technical means is the principal indicator of production flexibility and, together with the functional efficiency of programming, is becoming an indicator of the maturity of complex automation. In

this article, we therefore wish to attempt a comprehensive evaluation of the current situation as it pertains to program products from the standpoint of the requirements levied upon them by complex automation. The evaluation encompasses existing standard applicational programs (TAPV) such as VARS, MARS, and the results of the solutions of research and development tasks at the Engineering Technology and Economics Research Institute (VUSTE).

1. Cumulative Evaluation of Program Products From the Standpoint of Requirements of Complex Automation at the Plant-Enterprise Level in the Individual Areas of the Control System and in Preproduction Stages

1.1. The Integrated ASR [Automatic System of Control] System as a Whole (IASR)

At the VUSTE, we worked out a logical-methodological concept of an integrated IASR, including the gradual steps for its implementation. For the extent of principal production, this concept was experimentally verified at the plant level at the TOS Hostivar National Enterprise and to a broader extent, which includes selected activities of enterprisewide management, is being experimentally verified within the Motorlet National Enterprise.

The degree of integration between strategic management, tactical management, and operational control of production is low for the time being, but not from the standpoint of logic; rather from the standpoint of the extent of automation or implementation in the continuous operation regime.

Within the framework of the adopted Program of Complex Automation and Creation of Instruments for Its Realization and within the framework of participation by the VUSTE in solving the "Priority Direction No 2," work on the further development of the IASR concept is being initiated in harmony with the world development of technical and program means, which facilitate a higher degree of integration. In conjunction with the use of personal computers in management and in preproduction phases, we have initiated work on the integration of existing computerized enterprise management systems (ASRP) and the creation of decentralized special-purpose data banks for preproduction phases and for the control of production in real time. Currently, we are creating instruments for informational integration between program products which have been developed in isolation from each other. Currently, these isolated program products, for the most part, encompass the operational control of production; furthermore, they involve, in part, the preproduction stages and some other areas.

In view of the fact that a number of enterprises already have introduced ASR within the framework of the rationalization of management on the basis of TAPV MARS or VARS, the immediate step in the creation of an integrated IASR will be to assure ties between completed modules and the tasks and data bank of the existing

ASR, in other words, the establishment of an interconnection to the VARS. Thus, the first step will assure a certain coverage of the principal components of the automated system of control. In the second step, an integrating unified database will be created, accompanied by a simultaneous expansion of automation to related functions in verified "cores" of the automated direct control in real time, as, for example, activities involved in the capital goods distribution (MTZ), in cost and price calculation, etc. This will assure a higher quality level for the work involving all data required by the IASR.

In a final step, all key components of an IASR will be created anew in such a manner that they would already be responsive to the concept of working within a unified information environment and would be responsive to the requirements for the quality of substantive management (for example, work in an interactive method in real time) and particularly under new conditions dictated by the restructuring of the economic mechanism. Here, the key question will be the thorough bonding between the functions of sales, supplies, and the technical economic plan (THP) with the actual sector production control plan (ORV) into one flexible entity. Only in such a case will it be possible to carry out variable calculations and to follow changes in the production process in dependence upon external changes.

1.2. All-Enterprise (Strategic, Tactical, and Operational) Management

For the purpose of creating the concept of long-term development of an enterprise, the VUSTE worked out and verified a methodology for processing and a method for the synthetic numerical evaluation of a verbally formulated developmental model. It has three levels of detail. The variants for the numerical expression of development are worked out interactively using a personal computer and programming support also deals with modeling the course of individual magnitudes or parameters in time.

To assist in processing the concept of enterprise development, we have additional programming instruments. For example, we utilize a programming module (the basis for which is the method proposed by Professor Brabec to provide detail analysis of existing development on the basis of plan information deposited in the database of the State Planning Commission, which makes it possible to even draw certain conclusions for predicting the future. In the area of mid-range management, we have developed and verified a module for automatic technical-economic planning. A program for a personal computer is available which makes it possible to compile the principal parts of the technical-economic plan with the aid of a computer in different versions to facilitate optimum choices. A part of this program is the automated evaluation of the influence of rationalization actions upon the economic results achieved by the enterprise. Another area of top management is the strategic

preparation of products—something we have assigned to the preproduction phases. Czechoslovakia lacks the necessary programs, both basic programs and also user programs to facilitate broader application of computers in all-enterprise management, particularly in the area of creative activity.

Future development of programming for this area should progress in the following directions:

- Creation of program modules for individual areas of strategic management (development of a production base, social development, etc.) utilizing already created ASRP databases while using other methods to process existing information (for example, regressive and correlation analyses, mathematical modeling, network graphics, etc.);
- creation of program modules to support strategic decisions, for example, decisions regarding the structure of production assortments, the degree of equipment at the production base, etc., utilizing progressive methods (such as, for example, the method of multicriteria decisionmaking, the analysis of the sensitivity of variants, etc.)

The solution lies in the application of programs which already exist in Czechoslovakia to specific enterprise conditions. The problem lies, on the one hand, in the difficulty of interpreting basic programming to make it usable for users and, on the other hand, in the necessity of the existence of selected special-purpose data:

- Utilization of expert systems in solving complex tasks of strategic management; the condition for the broader application of these new methods is, on the one hand, the importation into Czechoslovakia of so-called empty expert systems which facilitate practically random applications and, on the other hand, the timely training of management employees in the mastery of these systems;
- another direction is the broad utilization of programs to solve more or less routine activities involved in operational management, including administrative activities, which speed up and improve the quality of these activities and which free up space for creative activities on the part of the management and administrative apparatus; the barrier to the broad advent of automation into this area of activity is, on the one hand, a shortage of personal computers and, on the other hand, a shortage of user programs.

A review of the programs developed and verified for this area at the VUSTE is given in another chapter.

1.3. Integration of Preproduction and Production Phases (CAD/CAM)

The goal of this integration is to assure the transformation of decisionmaking and executive activities in design preparations, in the technological preparation of products, and in actual production into a form of data in such

a way as to assure the transmission of data between these components, the generation, transformation, and archiving of these data and its accessibility to all users with the aid of a computer (virtually without participation of man).

Figuratively stated, this means that work is to proceed with an idea picture of a technical object, for example, a product, through the form of a mental experiment facilitated by computer technology, beginning with the phase in which a functioning model is created, through its spatial design solution, technical calculations, experimental verification of its production process with the aid of simulation methods, which include the selection of the optimum course of production and the expression of the economic effect all the way through to the automated or automatically compiled technological process, including its transformation to numerical control programs and their automatic transmission to numerically controlled machines, in conjunction with the planned production tasks, which are also compiled either automatically or in an automated manner.

This type of computer integration is already fully mastered in developed countries and has been verified on projects of various size. An example of the realization of such CAD/CAM integration is the production of engines at the British Rover Co. [3]. Mature firms (for example, Siemens) have at their disposal a comprehensive system of value and program modules for various production-technical conditions which can facilitate CAD/CAM integration.

At the VUSTE, we have worked out a systems concept of this CAD/CAM integration and verified it with the use of various parts and production facilities in our CAD/CAM laboratory, which was established within the framework of the United Nations UNIDO campaign. Specifically, this project involved rotating components and press molds, for which design drawings were automatically worked out in the DAO program (in two dimensions) using a Model GIXI graphics station; also, operational technologies were worked out in PROMO language and postprocessors for the following production devices: a Model SPT-16 universal lathe with Model NC-660 numerical controls, a Model SPL-25 facing lathe with NS-421 numerical controls, and for two OCH and OCV machining centers with NS-471 controls.

For the present, the required prerequisites for a broader implementation of CAD/CAM integration do not exist in Czechoslovakia. Similarly, there are objective barriers in a high number of existing numerical control systems. It is estimated that Czechoslovakia has approximately 4,000 such systems. For broader utilization, there is a lack of technical and program modules and, for the present, no research and development task has even been established which would assure the development and production of such devices. The demanding nature of this task, given the variety of numerically controlled

programs, can be seen from the estimate of the labor intensity involved in one standard solution, which amounts to approximately 0.5 man-year.

Currently, better conditions for this integration are being created through the gradual realization of the universal NURIS control system. CAD/CAM integration would be speeded up and its broad implementation utilizing the NURIS system would be aided by the purchase of licenses from capitalist nations for the creation of hardware and software components (for example, on the basis of SIMATIK, SINNMERIC, and other modules of the Siemens firm) and by program products facilitating designing in 3D. Without this acceleration, there is the danger that the level of automation in the area of CAD/CAM will become a bottleneck in complex automation which will result in an imbalance between the extent of production automation, including its control (CAM) and perhaps the individual components of pre-production stages (CAD, CAP), on the one hand, and the extent of the automation of the integration tie-in between production and preproduction, on the other hand. This would mean, for example, that the transmission of working aids, products, tools to the work site would be automatic and the transfer of numerical control programs would be nonautomatic (manual transfer of tapes, etc.).

A further condition for achieving the target status of CAD/CAM integration is the assurance of unified progress on the basis of the created concept of CAD/CAM integration in the preliminary period, when there is a particular absence of the necessary HW modules. Procedures according to unified logical-methodological principles must provide for assuring integration in the transitional period through automation devices of a lower level which will gradually be replaced by higher-level devices without the need to change the entire concept.

1.4. Integration of New Program Modules With Standard Applicational Provisions (VARS, MARS)

The establishment of an integrated ASR at an enterprise level must emanate from the existing user environment in enterprises under the jurisdiction of the Federal Ministry of Metallurgy, Engineering, and the Electrotechnical Industry for which the broad application of standard applicational program equipment (TAPV) is characteristic, where TAPV MARS and TAPV VARS or possibly sectoral TAPV's, such as TOSIS, etc., prevail. The reason for this is that resources for creating a new generation of TAPV as extensive as, for example, the VARS, are not currently available.

That is why we at the VUSTE worked out some adjustments to TAPV's and verified them under concrete conditions, which are essential to the inclusion of new program modules for direct production control in real time and facilitate the automated solution of TPV tasks. We verified the implementation of program modules for

the direct control of production in real time at the enterprise and workshop level in TAPV TOSIS at the TOS plant at Hostivar; currently, we are working on modifying the TAPV VARS into TAPV MARS at the Motorlet Enterprise. We have achieved very good results in solving the integrated database for the technical preparation of production (TPV) for the SMEP series of computers. The integrated TPV databases developed at the VUSTE are capable of fulfilling some coincidental functions (in some details they, understandably, differ), such as, for example:

- the databases facilitate the interactive work regime (through the use of terminals) in real time, either with the assistance of a connected query system or through the use of a created applicational program;
- the databases facilitate the active realization of management changes (the actualization of information) with the following basic aspects:
- documentless contact between units accomplishing the change,
- formal logical control over the changes undertaken, in real time,
- the approval process, taking into account the hierarchical level of the changes undertaken,
- records of prepared and realized changes with respect to the product involved or the customer order involved,
- the archiving of the above changes is assured,
- the economic evaluation of a change is solved;
- the databases make possible the automated creation of design-technological documentation and changes in it (design material lists, technological material lists, technological processes including assembly procedures, the automated creation of operational texts, and connections to the automated determination of material requirements or time requirements);
- the databases facilitate the comprehensive assurance of the following informational subsystems:
- the information system regarding the purchased components involved in material lists (creation of a materials standard),
- an information system on items produced, both components and also items produced in assembly lines, with a selected structure of information permitting the evaluation of their design and technological similarities,
- an information system covering the tools, including their essential characteristics (special as well as communal tools);
- the databases make it possible to keep records and to control the course of preparation of technical documentation for the startup of new production or a custom order, etc.

1.5. Operational Production Control

Changes in the managed project, particularly the introduction of highly efficient and expensive production equipment, created the necessity for radical changes (innovations) in the system of management, particularly

in the area of operational production control at the enterprise level. These changes resulted in the need to reevaluate some traditional principles of management applicable to classical production. Fundamental changes in the existing logic of managing the production process resulted in the need to create completely new program modules to take care of automated or automatic control of some activities. The principal innovation changes in the logic of the management system, in comparison with the existing TAPV ASRP systems can be characterized as follows:

- In production control, a transition was made from the standards of worker time consumption to the standards of time consumed by technological work sites;
- control of the progress of the production process at the production center (in the workshop) is accomplished (in a differentiated manner according to the character of production or the technology used) with the aid of automated or automatic systems of direct control of the actual production process in real time; the essence of direct control of the actual production process in real time lies in the fact that the decision regarding the tasks of the technological work site is accepted on the basis of precise knowledge of the status of the production process and of conditions governing its continuation at the instant of decisionmaking;
- each production center receives its detailed operational plan from the enterprise management level, that is to say, its binding plan covering finished production (from the standpoint of the center) and a time limit projection covering the operations as a guideline; in contrast to existing customs, the detailed operational plan is drawn up for a relatively short time period, most frequently for a period of 2 weeks; at the end of each week, the plan is brought up-to-date and moved up for another week;
- the planned management level controls the progress of production in all of the principal production stages; the enterprise management level uses operational plans for all production centers, as well as for its own management activities which are based on tasks set for the principal production stages by the plan of final production;
- an important element of the enterprise management level is the so-called enterprise management center, which is an organ of direct control over the actual production process in real time throughout the production facility, from materials warehouses to the output of the

final product from the assembly line, is equipped with a controlling computer which encompasses the hierarchy of direct control over the production process, even though the level of control automation in the individual production centers may vary; the schematic shown in Figure 1 makes it clear that the system is a two-stage one (enterprise-center), is supplemented by the operational technical recordkeeping facility of the warehouses, and that direct control in the production center is either automated or manual;

- the operational recordkeeping pertaining to supplies (warehouses) is automated in real time and embodies all operations containing information ranging from the receipt of materials to be warehoused through its issuance to production facilities, including tie-ins to the capital goods distribution system;
- the logic-methodological basis of operational production control and the method of technical support make possible a gradual transition to documentless management, including recordkeeping;
- the consistent application of value control, in conjunction with natural management with the aid of the instrument of complete intraenterprise cost accounting; a fundamental change in comparison with surviving methods in our enterprises is the transition from the surcharge apportioning of production costs to calculating costs using time rates applicable to the processed costs.

An overview of program modules in this area is listed in another chapter.

2. Cumulative Overview of VUSTE Program Modules To Support an Integrated ASR for Engineering Plants and Enterprises

For purposes of better illustrating the functionality and the locations of individual program modules in the complex automation of production organisms of various types, the schematics of Figures 1 and 2 are intended to illustrate the modular integrated ASR in segmented form at the level of enterprise management, at the level of plant and shop management. The principal modules which comprise an integrated IASR are designated by circled numbers which are augmented, in Table 1, by attached solved and, for the most part verified, program modules at the VUSTE which are widely utilized in engineering practice.
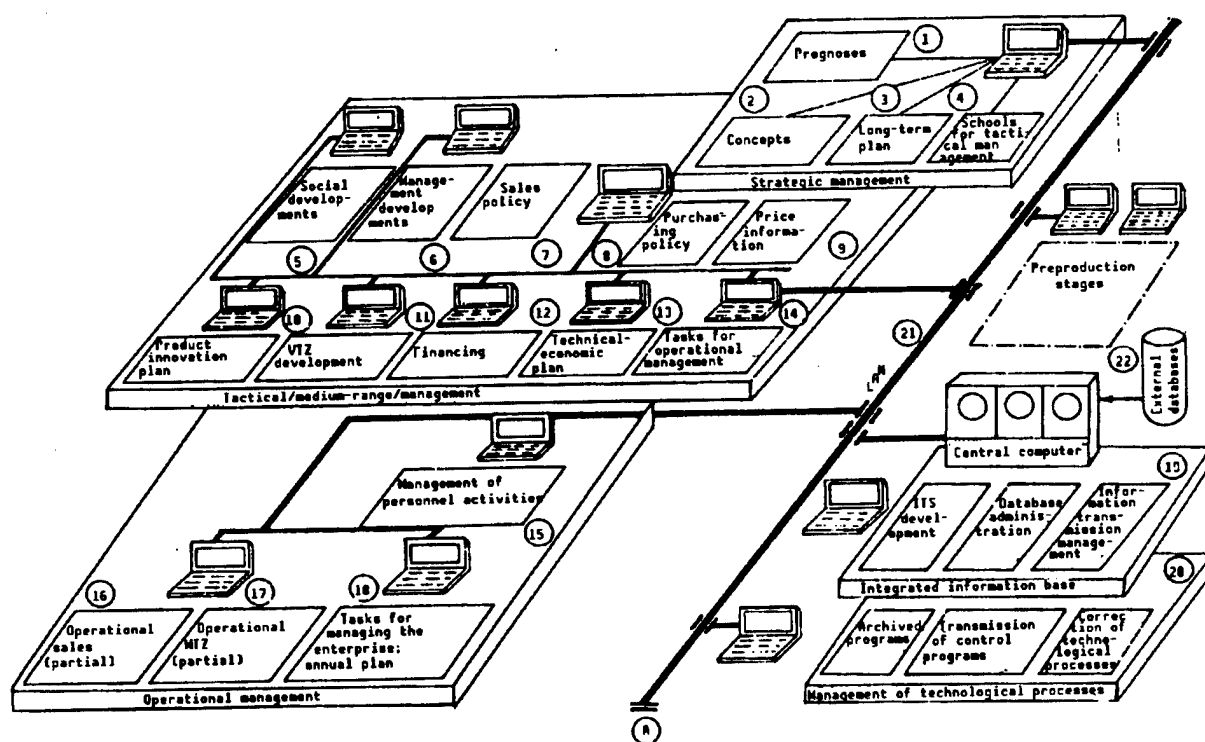
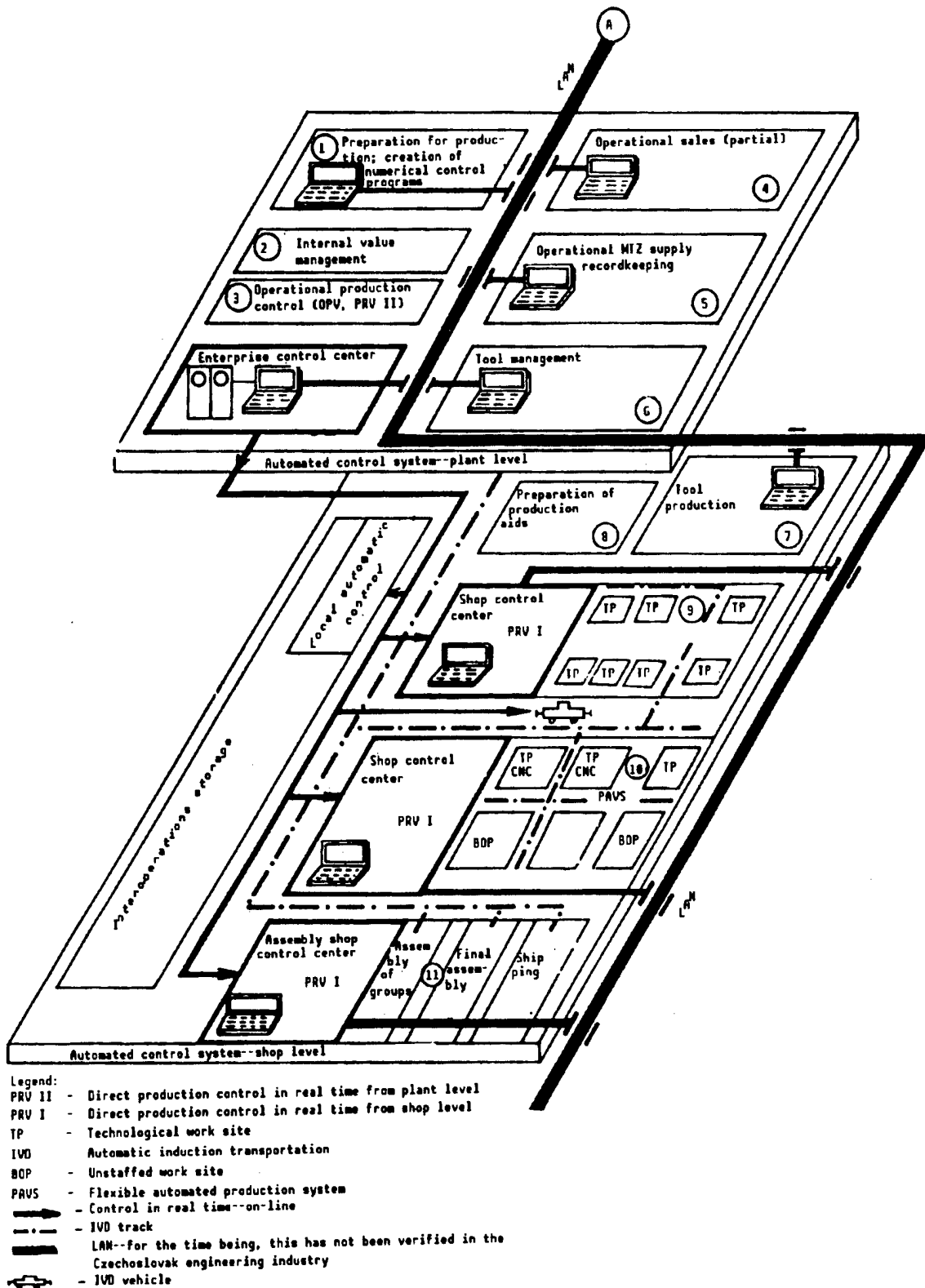**Figure 1. Modular integrated ASR—VUSTE. Level: enterprise.**

Figure 2. Modular integrated ASR—VUSTE. Level: plant, shop.

Table 1. Overview of Verified Program Modules for an Integrated ASR

Module Number According to Picture	Functional Description of Program Products	Title of Program Products
	A. All-enterprise management level (Figure 1)	
1	Program for the passportization of the production base in the engineering industry	
2	Program for the retrospective analysis of management at the enterprise	
3	Program for modeling the economic development of the enterprise	
5, 15	Program to support and control cadre personnel developments	KAPR
6	Program for perfecting the organizational development and the organization of the enterprise structure	ORG
10	Program for planning the activities involved in technical production preparation	JASPIS
22	Program for the analysis and evaluation of product technical levels	
11	Application program for modeling production systems and the program complex for:	
	—long-term modeling of repairs (5 years)	HODOP
	—planning of repairs (month, year)	HOGOP
	—operational control of repairs	
	Program for the analysis of the component base	
	Program for allocating machines and installations to given components and technologies	
13	Program for technical-economic planning	TEP
	Program for the automation of planning and the evaluation of rationalization actions	APRA
19	Program for utilizing the IDMS and DABASYS databases	
20	Program for data communication for CAD/CAM integration programs:	
	—for scientific-technical computations	GENEL
	—for drafting	AUTO-CAD
	—for maintaining the library of design documentation	
	—library of technological processes	ASEPO-dBASE
	B. Plant-level management (Figure 2)	
	Programs:	
1	—small automated system for use by the technologist	
	—for the automated setting of times	
22	—for the automatic compilation of production processes encompassing several professions	ASEPO
	Programs:	
	—for short-term operational production planning	POP
	—for direct production control in real time from plant level	PRV II
5	—for operational technical supply recordkeeping	OTEZ
	C. Shop level (Figure 2)	
	Programs:	
7	—to organize and control the production of tools	
	—to manage tools	
	—to propose the technology of tools	
7, 9, 1	Program—Advisory and Recordkeeping System of Production Control (with a lower level of management automation)	PSV
9	Program for technical diagnostics pertaining to production installations	
	SW for capacity PAVS calculations	
	SW for proposed technological dispositions	
10	Automated production processes or automatic control of production processes in real time	PES

More detailed data are given in the catalogues of the VUSTE, which may be ordered by anyone who is interested.

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GDR: CAD Data Base Management System

[Article by Dr K. Loeschke, VEB Combine Ball Bearing and Standard Parts: "LADA—A Roller Bearing Data Base and Selection System for CAD Systems"]

[Text]

Basic Considerations

CAD will be a necessary part of a future CIM complex. The development of CAD solutions has a long tradition in the GDR dating back to the sixties. However, this modern method of designing engineering solutions was not emphasized until workstation computers became available. In the past few years, a great number of designers, electronics engineers, technical experts and information specialists were able to gain a lot of experience with powerful 16- and 32-bit technology using commercially available CAD programs. This experience should now be utilized in order to actually realize the planned effectiveness of such technology. This is true in particular with regard to the series production of the AC 7150 and the EC 1834.

Obviously, this requires the combination of commercially available CAD programs (drawing editors), commercially available computation programs (e.g. finite elements (FEM)-programs) with in-house, user-specific modules. In a CAD system which emerges from such a combination CAD-oriented data bases and AI- (artificial intelligence) oriented selection and advisory systems (expert systems) assume the role of pacesetters. Figure 1 shows a diagram of such a general CAD system.

CAD users will certainly have to develop their own software solutions. However, the international situation indicates that adapted or commercially developed software plays a dominant role. This also applies to the provision of data bases as well as knowledge bases in connection with their management programs. Software must be produced at the location where it has its basis. Standard parts data bases should be produced, maintained and offered by producers of standard parts. The combine roller bearings and standard parts of the GDR (KWN) accepted this challenge; since January 1988, it has been offering users and designers in industry the CAD data base module LADA, which manages the data base "roller bearings" as part of a CAD system (see Figure 1).

Since at present the GDR does not have a central data network and does not expect to have one in the foreseeable future, this data base including management programs will be made available on disk for decentralized PC-technology.

The Database and Selection System LADA

LADA (LAger-DAtenbank/Bearings-Database) was designed for 16/32 bit PC technology using the DCP operating system. However, a scaled-down version is available for the 8-bit PCs 1715 and 5120 and for the AC 7100 using SCP. The following discussion only refers to version 2.00 (DCP version).
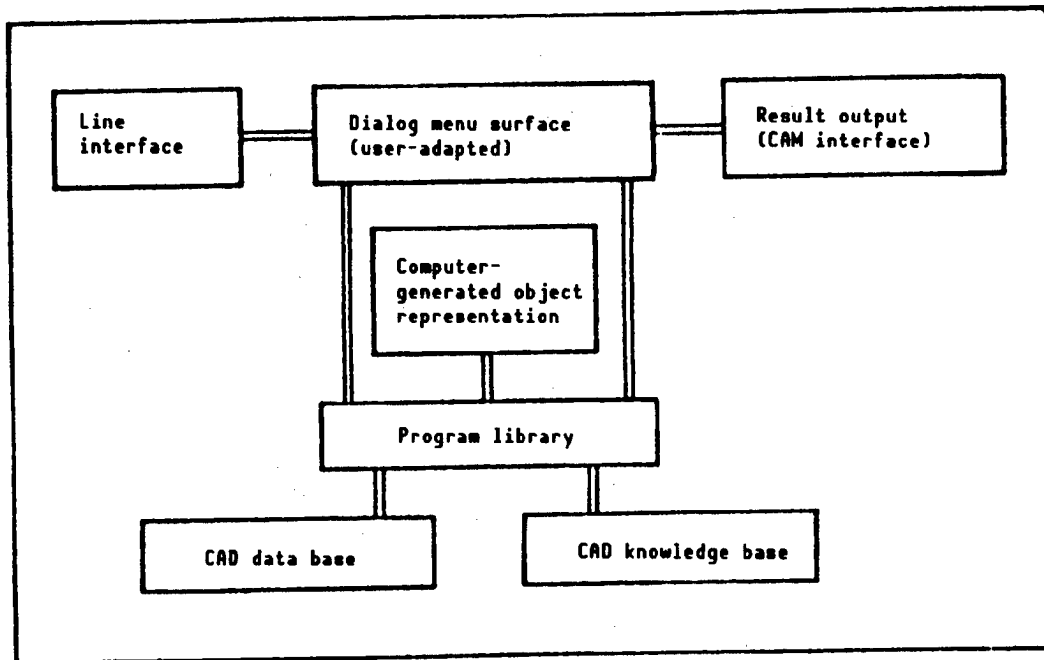
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┌─────────────────────────────────────────────────────────────────────┐
│  ┌──────────┐      ┌────────────────────┐      ┌──────────────────┐  │
│  │ Line     │      │ Dialog menu surface│      │ Result output    │  │
│  │ interface│──────│ (user-adapted)     │──────│ (CAM interface)  │  │
│  └──────────┘      └────────────────────┘      └──────────────────┘  │
│                       │   ┌──────────────┐   │                        │
│                       │   │ Computer-    │   │                        │
│                       │   │ generated    │   │                        │
│                       │   │ object       │   │                        │
│                       │   │ representation│  │                        │
│                       │   └──────────────┘   │                        │
│                    ┌────────────────────────┐                         │
│                    │    Program library     │                         │
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│                       │                │                               │
│              ┌────────────────┐  ┌──────────────────┐                 │
│              │ CAD data base  │  │ CAD knowledge base│                 │
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Figure 1. General CAD System.

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┌──────────────────────────────────────────────────────────────────────┐
│  ┌────────────────────────┐      ┌──────────────────────────────────┐ │
│  │ User's calculation and │      │ LAX--Roller bearings; expert     │ │
│  │ design program         │      │ system; consultation; bearing    │ │
│  │                        │      │ selection; damage analysis;      │ │
│  │                        │      │ diagnosis                        │ │
│  └────────────────────────┘      └──────────────────────────────────┘ │
│  ┌──────────┐  ┌───────────────────────────────┐  ┌─────────────────┐ │
│  │ LADAOPT  │  │ LADA--Management system:      │  │ LADAPIC--       │ │
│  │calculation│ │     Data management           │  │ Image file      │ │
│  │ system   │  │     Interface management      │  │ generation;     │ │
│  │          │  │     Search system             │  │ CAD represen-   │ │
│  │          │  │     Dialog system             │  │ tations         │ │
│  └──────────┘  └───────────────────────────────┘  └─────────────────┘ │
│                  ┌───────────────────────────┐                        │
│                  │ LADABAS--Data base:       │                        │
│                  │     Roller bearing data   │                        │
│                  │     Order catalog         │                        │
│                  └───────────────────────────┘                        │
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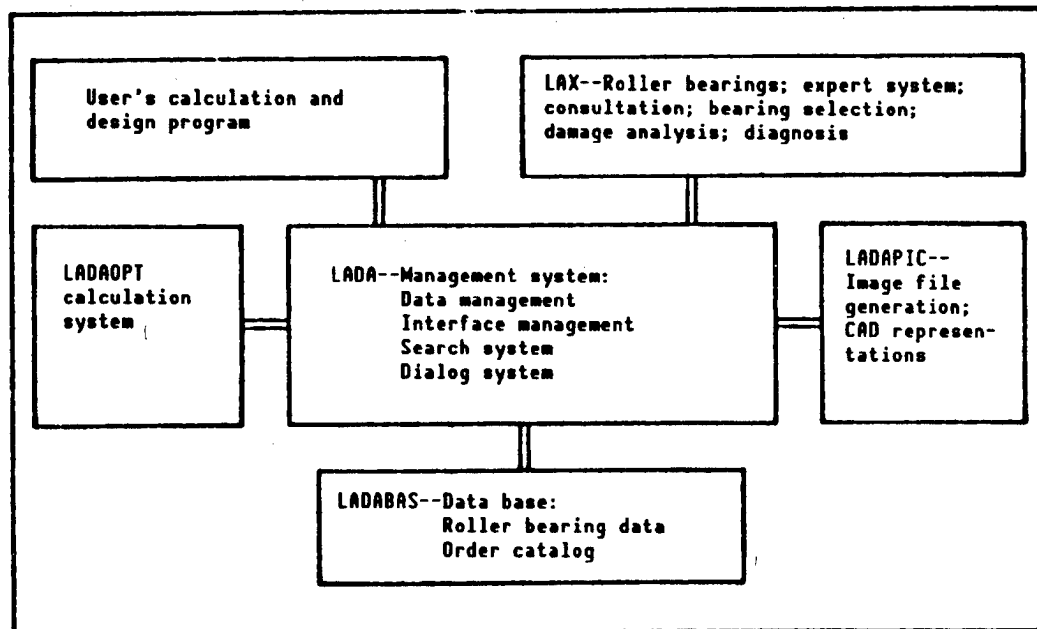
Figure 2. General LADA Concept.

LADA consists of a data base whose files are compatible with REDABAS-III. It contains all data relating to roller bearings from a roller bearing catalog as well as additional data in 38 files (approx. 1 MB). The program system LADA manages this database and contains programs for calculating useful life, interface management, image file generation and image file conversion. All these programs together use approximately an additional 500 KB.

In addition to the engineering data base there is a KWN order catalog (approx. 300 KB). It is recommended to store the system on a hard disk.

LADA can be used both as an independent program (or program system) primarily in the dialog mode using menus, or it can be integrated as a module of larger programs. The "openness" of LADA is ensured by clearly defined input and output interfaces which can communicate with any other program via ASCII-readable sequential files.

The KWN maintains and updates the database. The program design emphasizes user friendliness and ease of operation.

LADA Program Features

—Page-by-Page Reviewing

Page-by-page reviewing allows the convenient review of the LADA data base together with a search support. All LADA files and existing interface files can be reviewed. Files cannot be printed out in full.

—Search

The search constitutes the core of LADA and can also be called up automatically from other programs via interface files. In this connection, batch processing using DCP is a very useful possibility.

With the help of a menu, the user prepares a search request consisting of various roller bearing parameters with any desired limits. LADA searches either the complete base or, if desired, only certain files. A typical search for a specific roller bearing design which must fulfill specified geometric requirements takes approximately 20 to 30 seconds. Limiting the number of files to be searched as well as a sufficiently large RAM disk considerably reduces the search time. After a successful search the bearings found and all their parameters are placed in the result interface file.

—Calculation of Useful Life

For further processing of the search results, LADA features a modified function for calculating useful life. Loads for a maximum of nine load levels can be specified. The result consists of the modified useful life and the factor a23 as well as comments.

—Generation of Image Files

This menu item connects to graphic CAD modules. It generates sectional views to scale for all actual roller bearings. This program section is based on the consideration that it takes a lot more memory to store bearings as complete CAD drawings than to have the program generate them each time as required by the user. To accomodate the many different CAD editors, LADA first generates a general image file which the user can convert to the internal representation of his graphics editor using conversion programs. LADA supports the following editors: MultiCAD, PC-CAD, CADdy, AS2000, AutoCAD and GEDIT.

—Help Function

LADA contains help texts which can be called up with 'H' from practically any input situation. Then, the help text for the current menu appears on the screen.

Use of LADA

LADA can be used in different ways. Primary applications are the design of machinery and machine elements. For this purpose, LADA can be used both as an "electronic catalog" and as a support for the preparation of drawings. For the preparation of production and technology, LADA can supply data which facilitate the ordering of bearings (KWN order catalog). "Open", user-oriented files within LADA allow the management of other operational data using LADA (root data).

Developers of programs for more extensive CAD systems can use LADA as a module for searches within the data base for roller bearings and as a source text for the development of similar data management systems.

With annual data revisions, the user has at his workstation at all times a complete DP-oriented engineering catalog for roller bearings which are frequently used as standard design parts.

Advanced Developments

Before the end of this year, an AI-oriented advisory and selection system for roller bearings (LAX) (as shown in the general concept diagram in Figure 2) will be available which supports the selection of roller bearings for bearing assemblies using one or more bearings. In addition, KWN is starting to create a data base system for other standard parts ("NORD") to meet the enormous demand in this field as well.

CAD must be understood as a first, well designed component of a future CIM-opration. A CAD system is more than merely the application of graphics editors or individual calculation programs. CAD systems as workplace-related designer "tools" become fully effective only when used toegether with comprehensive CAD-oriented

data base systems. LADA, a data base module for roller bearings, represents an example of a module in user-configured CAD-systems.

(Dr Knut Loeschke (38) studied crystallography at the Karl-Marx-University from 1969-1973 and received his doctorate in 1976 (A) and 1984 (B) in the fields of semiconductor physics and crystal optics. Since the 1986 delegation agreement with the Combine Roller Bearings and Standard Parts, he has been subject leader for software development and head of the study group PC/S-technology.)

MICROELECTRONICS

Hungarian Electronics R&D Efforts Evaluated

[Article by Katalin Magos: "R&D Programs, at Half-Time"]

[Text] At a session held on the first working day of the new year the Council of Ministers heard a report about realization and further tasks of the National Medium-Range Research and Development Plan [OKKFT] for the Seventh 5-Year Plan period. Our article concerns the status of the G programs, connected with electronics. [passage omitted]

What is Six Percent Enough For?

Under the leadership of Mihaly Sandory, retired director general of the Microelectronics Enterprise [MEV], Gyula Sallai, director of the Postal Experimental Institute, and Bela Balogh, director general of the MEV, did the review of the G/1 electronification R&D program (computer technology, communications and automation).

Today the five-year production value of the electronics industry in Hungary can be put at 400 billion forints and by using the achievements of electronics another 20 billion forints value can be produced. According to international experience the development of a special area of this size would require R&D expenditures of at least 60 billion forints.

The planned central expenditure of 3.5 billion forints for the G/1 program is about 6 percent of this!

Within the framework of the program they are dealing with digitalization of the telecommunications networks, introduction of computer supported telecommunications networks, creating conditions for optical communications, building computer networks, development and spread of local area networks, development of systems for computer aided design, development of expert systems and creation of complex automation

systems. The mass spread of these system developments can be expected in the 1990's.

Harmonized license purchases by the communications engineering industry and the Hungarian Post Office in the area of digital telephone exchanges, microwave and digital transmission technology subsystems and optical communications are aimed at a coordinated development of the structure of the electronic equipment manufacturing industry.

Within the G/1 framework, in cooperation with the computer technology and automatics industry, they are modernizing new computer generations, peripheral equipment (such as graphic peripherals and optical memories), software development technologies, modular automation system elements and manufacturing technologies.

Long-range research connected with G/1 includes development of educational technologies, a study of the social effects of electronification, cell processors and transputers.

After the Fire

The G/5 program, research and development in electronic parts, had to be rescheduled because of the fire at the MEV. Janos Kazsmer, director general of Videoton, and Jozsef Palosi, retired director general of Tungsram, evaluated execution of the program.

In the area of microelectronics the program ensured maintaining the level of manufacture of discrete semiconductors and hybrid circuits. In regard to the manufacture of integrated circuits, the surviving bases were supplmented following the MEV fire and by 1988 they had formed an experimental plant with the capacity to make 40,000 four-inch wafers per year. In the years following 55 percent of the moneys of the program will serve R&D work on domestic IC manufacture.

In the area of non-microelectronic parts the G/5 program deals with R&D work on 12 parts groups (RC, electromechanics, ferrite and other elements) and will turn 26 percent of its moneys to this.

Eleven percent of the moneys of the program will develop Academy and industrial research bases; eight percent will go to electronics education faculties and related university research work at the BME [Budapest Technical University] and the Kalman Kando Electric Industry Technical College.

But there is a need for longer range technical-financial preparation, freeing up the strict division by cost type of the central resources and handling the investment allocation for R&D activity as a technical development fund—together with an increased foreign exchange component therein.

Islands

Zeno Terplan, a professor at the Heavy Industry University in Miskolc, led the committee reviewing the G/6 program covering the R&D tasks for electronic devices, and their production, connected with factory automation and precision engineering.

The committee members were Gyorgy Vernoczi, chief engineer at the SASAD GTI, Elemer Tertak Jr, a main department chief at the Hungarian Credit Bank, Imre Szucs, retired from the OMFB [National Technical Development Committee], and Ferenc Romvari, technical director fo the Raba Hungarian Car and Machine Factory.

The chief G/6 themes are: manufacturing automation, electronic manufacturing systems and supplementary automation; complex development of robot technology; research and development on precision engineering electronic devices and their production; research and development on automated technical design for the machine industry; and educational tasks (see our issue No 9, 1987).

International trends confirm the good selection of goals. Man cannot meet the ever increasing technological and quality requirements without the aid of automation and electronification. When G/6 was initiated they presumed a favorable change in the domestic economic environment and the starting of a central machine industry economic development program, which, however, was not realized. Out of necessity—due to the lack of other financial resources—they undertook tasks not strictly belonging to a machine industry R&D program (for example, support for basic education and infrastructure development). It would be better to change this practice in the future.

The original goal of the program was to develop the "capabilities" of the machine industry and so its effect will be realized over the longer run and indirectly.

As a direct result of G/6 thus far they have established flexible manufacturing system units, robotized work stations and the first industrial reference sites for computerized design; there are a few products which can be sold at a profit on the capitalist market; and conditions for technical education are improving. The most successful projects are based on international cooperation and license purchase, as, for example, the tool designing system of the FEG [possibly, Firearm and Gas Equipment Factory] and the manufacture and use of the REKARD welding robot.

The lack of a central machine industry development program is holding back a broad application of the achievements. The industrial enterprises have not gotten sufficient aid, incentives or preferences to introduce peak technology. The program's own resources make possible only the development of "islands" and unfortunately the drawing power of these at other enterprises is lacking—in the absence of investment resources.

Planned Expenditures for the Seventh 5-Year Plan (Billions of Forints)

Program	Central Technical Development Fund	Enterprise Sources	Budget Sources	Total
G/1	3.3	6.2	0.5	10
G/5	1.6	2.47	—	4.07
G/6	2.1	3.88	0.4	6.38

New G/6 Contracts

The cost prescription for 5 years for the G/6 manufacturing automation R&D program was 6.38 billion forints. As of summer last year—the middle of the plan period—the G/6 program office had signed 156 research and development contracts, to a value of nearly 5.6 billion forints. In the following table we summarize data on newer contracts—signed after March 1987—which are supported by larger sums or serve especially important, interesting developmental goals.

New G/6 Contracts

Contract Theme	Contracting or Coordinating Institution	Value of Contract (millions of forints)	Of This Central Technical Development Fund (plus Budget sources) (millions of forints)
Development of a cell control and status monitoring system	MTA SZTAKI	128.9	49.4(+35.5)
Development of a machine tool control family	EMG	114.0	38.0
A general integrated metal cutting manufacturing system	Videoton	287.8	60.0
A cell control and status monitoring system	Vilati	195.0	65.0
Compatibility monitoring	Flexys Co	17.0	17.0
Development of the next generation of robot controls	MTA SZTAKI	51.8	21.8(+20.0)
Development and manufacture of a new type painting robot	Micromatic Small Cooperative	39.0	13.0
Flexible manufacturing cell for welding ship industry parts	Ganz-Danubius Ship and Crane Factory	27.0	10.0
Robot car	Roboplan	39.0	13.0
Welding autobus side frames with robots	Ikarus	35.0	12.0
Developing, starting manufacture of, micromotors and robot drives (modifying the contract)	Industrial Instrument Factory, Iklad	208.9	74.3
Further development of the FF Solid 3D geometric modeling system and its machine industry use	MTA SZTAKI	45.0	20.0(+5.0)
Computerized design of group technology	Industrial Technology Institute	15.0	7.0
CAD/CAM in the area of die forming	Industrial Technology Institute	16.2	7.5(+0.4)
A database system for computerized design in plastic forming technologies	BME	15.1	6.6(+1.0)
Computerized product and manufacturing development for injection molding of plastics (preliminary contract)	Hungaria Synthetics Processing Enterprise	15.0	15.0
Adoption and application of an automated engineering design system (breaking down the contract)	Ganz-Mavag	130.1	25.0
Teaching robot technology	Kalman Kando Electric Industry Technical College	22.0	10.0
Teaching flexible manufacturing systems, robot technology and machine industry CAD	Mate Zalka Machine Industry Middle School	8.5	3.0
Teaching automation and robot technology	Gabor Egressy Technical Middle School	11.165	5.0
Retraining and further training courses	Industrial Leader Training Institute	22.15	8.0

Update on Plans for Integrated Circuit Production in Hungary

25020037 Budapest MAGYAR HIRLAP in Hungarian 27 Jan 89 p 7

[Interview with Lajos Koveskuti by Kristof G. Kocsis: "A Dream Undertaking? Electronic Mixed Enterprise; Whom Does Competition Favor?"]

[Excerpt] After several years of wrangling over reconstruction of domestic IC manufacture, which essentially went up in smoke in the 1986 fire at the Microelectronics Enterprise, experts last year finally outlined the creation, by 1991-92, of two new chip manufacturing bases. The larger is Intermos, a joint Soviet-Hungarian undertaking, which is to be established with an investment of about seven billion forints and, after production gets going, will produce so-called MOS circuits with modern (1.5 micron) technology on 120,000 large (150 mm diameter) silicon wafers per year.

A Foreign Manager

The smaller, Interbip, will process only 50,000 smaller (100 mm) silicon wafers to produce bipolar circuits which make up the larger part of present domestic needs. In this case the technology used is still modern though hardly in the front rank (3 micron), but it is well proven and American and Western European firms are ready to deliver the necessary equipment immediately.

Still the Interbip plans are worthy of attention because it would be the first mixed enterprise to be built in the country with really respectably sized foreign working capital, partly American, and with it American manufacturing organization and technical culture. According to the verbal agreements and statement of intentions capitalist firms will subscribe more than 30 percent of the 2.2 billion forints founding capital.

As for the domestic share holders the organizers of the company heaved a deep sigh a few days ago, when the Plenum of the OMFB [National Technical Development Committee] decided that in the event of suitable conditions 150 million forints from the central technical development fund would be contributed to the base capital. This sum would be far short of the 1.2 billion domestic capital share for at the last moment a number of enterprises stepped back from signing the agreement.

"Why?" we asked Lajos Koveskuti, president of the chief domestic share holder, OKISZ [National Federation of Artisan Cooperatives], and of the Communications Engineering Cooperative.

Lajos Koveskuti: Without doubt we would have liked to bring primarily producing enterprises into the founding of the company. And we had come to an agreement with a number of enterprises already. Videoton, for example, would have joined with 200 million forints but in the days preceding the signing of the contract there was a decision which so curtailed their socialist export profitability that they were finally forced to say no.

MAGYAR HIRLAP: Let us talk rather about your firm. It is said that the situation of the HT [Communications Engineering Cooperative] is not exactly rosy.

Lajos Koveskuti: Without doubt we have our problems. But this does not affect Interbip, for we have already gotten into the company with the already existing chip manufacturing technology tools—as a capital share. But it is certainly true that the case of the HT also is a good example of how incapable those wanting to introduce peak technology—despite their achievements—are of putting together the resources needed to keep up. Last year 440 million forints remained out of 2.2 billion in sales receipts after subtracting production and management costs. The production tax took half of this and after meeting our other obligations out of the profit thus generated a net of only 70 million remained. This year the situation will be even worse, the production tax is increasing from 13 to 24 percent and the sum remaining out of our profit will dwindle to 30-40 million. Out of this we must produce conditions for development of modern technology. And in addition under conditions such that last year, for example, we had to pay for equipment providing peak technology twice the price recalculated at the dollar rate of exchange, with the duty and afa [general consumption tax].

MAGYAR HIRLAP: Well, if that is the situation how can the joint stock company promise investors more favorable conditions than if their money were simply paid into the bank?

Lajos Koveskuti: If we look at the high domestic bank interest then we cannot, but we do not even promise more favorable conditions. There is no branch of industry in Hungary today which would pay a greater yield on invested capital than the bank interest. If this does not change soon then it will become questionable whether industry can develop. We plan a 10-13 percent capital yield, which is not at all bad in Western Europe. And we can guarantee this because the technology suitable for efficient series manufacture, the manufacturing culture, the work organization and the CAD/CAM system which the American side is providing together with know-how will be radically new in cooperative industry. In addition, in the first two years of starting up, a foreign manager will fill the post of plant director and he will have a free hand in selecting the work force, in wage payment and in maintaining work discipline.

In any case, our contact with the firm providing the know-how goes back more than 10 years, so they know the Hungarian possibilities well. They prepared the technological study plan for Interbip and they will cooperate in marketing too. Taking this into consideration we

intend at least 55 percent of production for capitalist markets, 15 percent of the production of Interbip will go to domestic users and the remaining 30 percent will be sold in socialist countries.

Mystification

MAGYAR HIRLAP: But the technology to be used at Interbip is at least 6-8 years old, competition in microelectronics is especially sharp in capitalist countries, the mass manufacturers have already cut out every imaginable source of loss. I would be very interested to know how a firm just starting to manufacture parts, with IC types approaching the end of their life cycle, intends to take over the market. On what can the profitability be based?

Lajos Koveskuti: The planned product assortment includes primarily integrated circuits in the case of which the intellectual work ratio is relatively high. For this very reason the American study bases profitability primarily on the undervaluation of domestic intellectual work. They calculate that if the income of engineer-technicians working at Interbip is double that of their domestic colleagues this will be sufficient incentive for their productivity, but even this pay is a good bit lower than that of a Western European engineer.

MAGYAR HIRLAP: So it is the well known formula, the "cheap" domestic intellectual work. The question is, can all this last over the long term? All the more so because the role of the human in microelectronic parts manufacture in the West is ever smaller, as is well known. Virtually everything is automated....

Lajos Koveskuti: Well, the other source for the profitability of Interbip is that the 6-8 year-old technology needed can be obtained very cheaply—largely from warehouse inventories. This can hardly be said of the newest peak technology, which we cannot get a good part of due to the embargo lists. It is true that the older machine park requires more well trained experts, and the price-cost calculations unambiguously indicate that we will be better off this way.

In any case it is an error to mystify automation. The goal is not automation at any price but rather the minimization of costs. A characteristic example is that when the study plan was being prepared the domestic engineers got into a debate with the American leaders. The former recommended complete automation of a work process, which could have done the work of five men. Finally the Americans won, because they were able to prove that the more economical solution in Hungary was partial automation of this work phase, keeping the five men, because this could increase profit.

The Market Selects

MAGYAR HIRLAP: Permit me one final question. You obviously know that many experts are against creation of Interbip. Their chief argument is that—if everything goes according to plan—within 2-3 years Intermos, Interbip and the MEV [Microelectronics Enterprise] together will be producing many times the domestic IC need. So—they say—in the present economic situation it is simply a crime to create parallel capacity to such a degree.

Lajos Koveskuti: It will only benefit domestic microelectronics if a buyer's market develops and the monopoly sitution ends; this will stimulate more efficient production and increase the reliability of parts supply. The market will select who is able to stay up in what I also expect to be a sharp competition. But there is no law that any of them will bleed to death because even in neighboring Austria, for example, I could mention a number of enterprises only a small proportion of the production of which is placed on the domestic market. Although it is true that to do this one must learn to trade well as soon as possible.

System Concept for New GDR Video Interface for Image Processing

[Article by Dr Thomas Wolf and Matthias Fischer of the Physics/Electronic Components Section of the Technical University of Karl-Marx-Stadt: "Video Interface for the L 211 CCD Matrix"; first paragraph is introduction]

[Text] The video interface makes it possible to perform image processing tasks. By using a U 82720 graphic display controller, the entire hardware can be concentrated on driving the L 211 CCD matrix sensor on one board. In the following article, the system concept for the interface unit is introduced.

Rapid developments in microelectronics have formed the basis for extensive use of computer technology in a broad range of sectors in the national economy. Today it is impossible to imagine life without microcomputers in science and research, but also increasingly in the control and supervision of production processes. Nevertheless, it is still not possible to achieve drastic increases in economic efficiency through computers. Sensors, for recording input data, and actors, which are used to control processes, are necessary coupling links between the microcomputer and the production process.

Coupling simple sensors, such as temperature, pressure and humidity sensors, is possible with relatively few problems. Solutions in which A/D converters and one-chip microcomputers perform control and data evaluation functions for these types of sensors are well-known, and have been presented in many publications.

Significantly more difficult is the use of more complex sensors, including CCD lines and CCD matrices. These components provide an extremely large volume of data with a high output speed. If a CCD matrix with 512 x 576 dots is used and resolution is supposed to be 6 bits/pel, then there must be image memory of more than 256 Kbytes that is described every 100 ns with a data word.

These requirements show clearly that such system solutions demand a high expenditure on development, and that this is not restricted to hardware. A software program to process this image information automatically or interactively presupposes a high level of theoretical knowledge of image processing operations, which can guarantee success only in conjunction with a solid programming method. These are some of the reasons that the CCD matrix in particular is being used in efficiency optimization measures only with great hesitation, although there is a pressing need for completed system solutions.

System Concept

The task at the Technical University of Karl-Marx-Stadt was to develop an interface for a CCD matrix that could be used in a wide range of applications. The spectrum extends from medical technology, especially ophthalmology, to measurement and supervision technology in microelectronics and precision equipment, to agriculture.

This interface must feature several important performance parameters, so that broad-scale use is ensured. A summary of the technical data is found in Table 1.

Table 1. Technical Data for the Video Interface

Image recording sensor	L 211 C
Image memory size	128 Kbyte
Processing width	1 or 2 bits/pel
Graphic controller	U 82720 DC 03
Graphic capability	All drawing functions of the U 82720 usable
Pel clock rate	10 or 5 MHz (programmable)
Typical image sizes	224 x 244 pels (5 MHz/camera operation)
	480 x 288 pels (10 MHz, only graphics)
Number of storable images	10 or 20
Output signal	Signals for 2 color channels (4 color combinations) or analog signal for 4 gray steps
Monitor	TTL outputs or BAS signal usable B&W and color television receivers adaptable
Power supply	Approx. 5 V (from computer) 24 V (external)
Computer interface	K-1520 system bus, TGL 37271/01
Circuit board format	215 mm x 170 mm (EGS)

The L 211 CCD matrix from Werk fuer Fernsehelektronik in Berlin was used as the sensor component. This matrix offers resolution of 190 x 244 pels/image. The information is digitalized into either 1- or 2-bit data and stored in an image memory, which with a size of 128 Kbyte is a component of the interface. In this way, 10 to 20 images can be processed simultaneously in the memory, depending on resolution.

One of the most important performance criteria is the possibility of depicting the digitalized image information on a display. Because of this, it is possible not only to visually evaluate the recorded image information, but also to graphically depict changes, comparisons and adjustments in the images as performed by the linked computer.

The interface is positioned on a printed circuit board measuring 215 mm x 170 mm, and is K-1520-compatible. Because of three voltage controllers on the board, the various supply voltages for the CCD matrix are gained from only one external voltage source. The CCD matrix is positioned in a special camera head containing only the drivers for the clock signals and an amplifier for the video signal.

Technical Configuration

The interface is based on the U 82720 graphic display controller, which is used to construct graphic units according to the principle of raster graphics. It provides all the signals to drive an image memory, to readout and modify data in the memory and to synchronize a connected display. A microcomputer is linked by way of I/O commands and by activating the corresponding bus control signals. For data exchanges between the image memory and the computer, high-power DMA operations can be used. A detailed description of the graphic display controller and its potential applications in graphics modules can be found in (1) through (6).

If the necessary signals for driving a CCD matrix are compared to those provided by a graphic display controller for a raster graphic, it is seen that the cycle rate diagrams are similar at many points. It now seemed reasonable to connect a graphic display controller directly with a CCD matrix and to derive the cycles for the matrix from the control signals of the GDC. In this way, the horizontal and vertical shift cycles as well as the photo cycle for the matrix is generated. The video signal of the matrix is amplified and converted into 2-bit digital information with the help of three comparators. These data are transformed in two 8-bit shift registers, functioning as serial-parallel converters, in such a way that they can be written directly into image memory.

Figure 1 shows the block structure and Figure 2 the cycle configuration of the interface component. The graphic display controller works in normal display cycles. Address information for the image memory is made available, and the data are read from the memory and
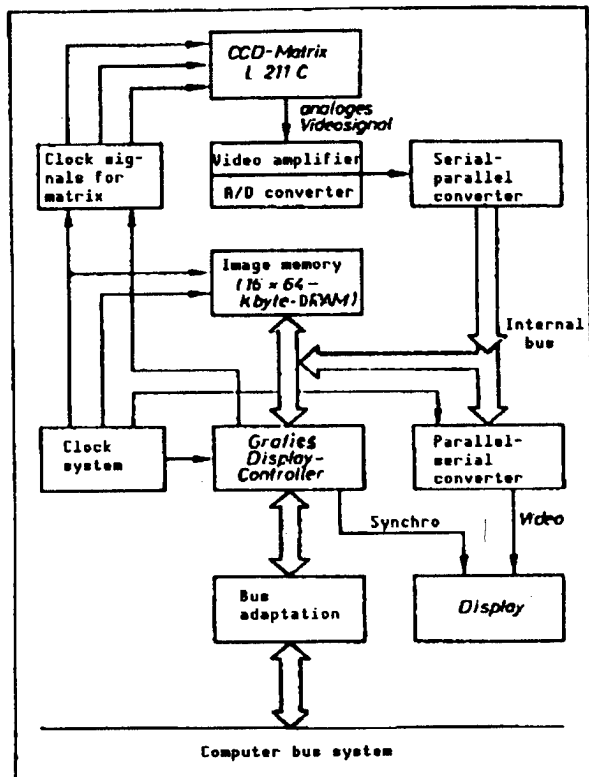
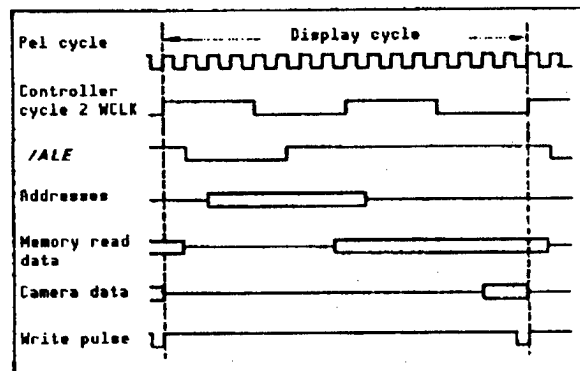Figure 1. Block Structure of the Video Interface.

Figure 2. Cycle Diagram of the Drive Circuit.

In the present interface, an apportionment into 2 x 8 bits is undertaken. In this way, 2 bits can be stored in memory for each pel. The clock rate of the picture element is set for 5 MHz. This frequency comes from the maximum possible horizontal cycle of the CCD matrix, 7 MHz.

The implemented configuration of the interface also makes possible its use as a pure graphics output module. Here, all programmable functions of the graphic display controller for drawing and data transfer can be utilized. In addition, the frequency of the pel cycle can be programmed to be 10 MHz, which produces an increase in horizontal resolution and a raster graphic with 480 x 288 pels. Table 2 shows the correspondences between programmable clock frequencies.

Table 2. Programmable Modes of Operation.

Pel cycle in MHz	Controller cycle in MHz	Data width in bits	Shift register in bits	Camera function	Graphic function
10	2.5	2	2 x 8	no	yes
10	1.25	1	1 x 16	no	yes
5	1.25	2	2 x 8	yes	yes
5	0.625	1	1 x 16	yes	yes

Monitor Connection

The operation of the interface is such that 1- or 2-bit video information is possible, whereby the former results in a monochrome display. It is possible either to direct the complete signal to a display or to use the TTL outputs of the interface. In the 2-bit variant, two channels of a color display can be used, and four colors are depicted. On the other hand, the representation can also be in the form of four gray steps in a black and white display.

Software

Using the graphic display controller in the interface component requires by necessity that this circuit be

written into the two video shift registers, which as parallel-serial converters make the image information available to the display. It was found to be possible to insert an additional memory writing operation in this display cycle. At the end of the controller's second display cycle, the image information is switched from the serial-parallel converter to the internal bus, and by generating a write pulse the READ cycles of the memory component are expanded to READ-MODIFY-WRITE cycles. In this way, the digitalized image is written into the image memory of the graphic display controller and shown on the display when the memory cells are next read out (7).

Memory Organization

The graphic display controller is designed in such a way that one 16-bit word is read out from memory in each display cycle. In standard applications, this data information is converted into a video signal in a 16-bit parallel-serial converter. This process gives a width of 1 bit/pel. If there is more than 1 bit/pel to be processed, it is possible to provide more memory levels in parallel (1) through (4). However, the 16-bit data word can also be distributed among several levels. One possible method, resulting in an increase to 4 bits/pel is described in (5) and (6).

programmed according to the clock rates and modes of operation used. Thus, autonomous use is not possible without a connected computer.

A software package was developed for the interface that, besides the necessary initialization, can also perform a series of basic functions. The following program elements can be used for general applications:

- Monitor function for continual recording and display of image information
- Single image recording
- Storing images on diskette
- Reading from diskette and display of image information
- Printout of images.

Special program elements were developed for the image processing functions that are adapted to the concrete tasks. These routines include, for example, image adjustment, tracing object contours and length and surface measurement.

The extent to which it is possible to use the graphic display controller directly for image processing functions was also studied (8). By making full use of its drawing functions, the computer can be relieved of several image processing functions, preferably with binary images having a processing width of 1 bit. The graphic display controller can then be used to determine object contours or to discern image differences through an appropriate superimposition of image information. Using this method, image analysis tasks can also be performed in a feasible amount of computing time using 8-bit microcomputers. All program elements were developed in Turbo-Pascal, whereby time-critical routines were inserted as assembler procedures. This structure allows for an extremely high degree of flexibility in adapting the software to a broad range of applications. For complete image processing projects, a specially adapted software package must be developed in most cases. Our use of general program modules could reduce expenditures on development somewhat. It is always essential to check whether fully automatic processing is necessary and viable, or whether a more effective solution to the tasks can be found in the dialogue with the user, since fully automatic image processing generally demands a significantly higher expenditure on software.

Summary

The interface for image processing presented, which contains an L 211 CCD matrix as a sensor component, can be very flexible for a broad range of automation, measurement and supervision processes. By complementing the image recording function with a graphic output module, the stored image information can be displayed and modified. It is also possible to use it as a purely graphic module, without a camera hookup. The use of a U 82720 graphic display controller allows a
highly effective drawing function. Mounting all function groups on only one printed circuit board and full K-1520 bus compatibility are the preconditions for universal use.

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Survey of Polish Developments in Electronics and Applications

[Article by Jaroslaw Swiderski: "Electronic Landscape; Where Are the Microprocessors Hidden?"]

The following article is excerpted from the study by Dr Jaroslaw Swiderski, acting director of the Institute of Electron Technology, "General Problems of the Applications of Electronics to the National Economy."

[Text] Microelectronic technologies are of strategic importance to both economic and military development, and hence the consequences of underdevelopment in this field and dependence on shipments from other countries are tantamount to a political choice. It is difficult to find any country of importance on the world scene that would abandon developing microelectronics. The highly developed countries now and again make extraordinary efforts to keep up with any advances in this field.

Owing to a catastrophic shortage of integrated circuits, especially the large-scale ones, in Poland, the development of electronics in this country is skewed. It is chiefly the domains and enterprises which have succeeded, often fortuitously, in gaining priority to shipments of microelectronic components manufactured domestically or by the CEMA countries, as well as those which (while not requiring large quantities of integrated circuits) succeeded in assuring private imports for themselves, that are developing.

Nearly 700,000 video recorders have reached Poland through so-called private imports.

On the Polish computer market the state-run potentate is the ELWRO Electronics Plant in Wroclaw. It manufactures central processing units for R-34 large computers, teleprocessors, computer terminals, and microcomputers. However, it is just beginning to manufacture microcomputers. In 1987 it commenced the production of the Elwro 800 professional ccomputer and its "younger brother," the Elwro 800 Junior, a school computer. It is expected that by 1990 the plant will produce 30,000 Elwro 800's and 100,000 Elwro 800 Juniors annually. The other microcomputers manufactured at present (or rather assembledI at Polish state plants are: Meritum II, Com PAN, Bosman 8 (in preparation), MK 45, Mera 660, and Mazowia 1016. Only the last-named computer, an IBM PC/XT clone, appears to have a "future in production." It is relativelymodern and its makers have a chance to produce it in quantities of the order of 30,000 annually.

The ERA Warsaw Measuring Instruments and Computer Factory, which specializes in providing computer systems (chiefly on the basis of Soviet subassemblies) to the USSR, where more than 1,500 computers of that factory already are operating, also deserves mention. The experience gained by that factory has made it possible to establish the POLSIB Polish-Soviet Electronics Joint Venture, on the initiative of the Siberian Affiliate of the USSR Academy of Sciences and a group of Polish enterprises, well-known exporters of computational equipment to the Land of the Soviets. Its purpose is to facilitate the flow of technical thought (equipment blueprints and software) from Soviet R&D institutions to the Polish computer industry, which will develop series production of the most up-to-date data processing equipment. POLSIB will attend to coordinating the activities of the partners as regards R&D cooperation and applications and the production of hardware and software. POLSIB's program of action, which presupposes among other things the establishment of several branches on USSR territory, also envisages advertising and marketing operations as well as the possibility of cooperating with third-party countries.

As regards peripheral computer hardware, only the MERA-Blonie Printer Factory counts on the CEMA scale; it makes the highly successful D100A dot-matrix printer (about 30,000 printers a year, of which more than 60 percent is exported). In addition, good monochrome monitors (e.g. Mera 7953, CM 7209) are manufactured by MERA-Elzab in Zabrze, while MERA-Kfap in Krakow is gearing itself to manufacture floppy diskettes. MERA-Ster in Katowice and MERA-Poltik in Lodz intend—they have the prototypes—to manufacture plotters and graphics microprinters.

The microcomputer-assembling companies are led by PZ Karen (IBM PC/AT and XT clones, software, and servicing of IBM and Atari) as well as Emix, Impol, and Computex. Ready-made foreign computers brought in by private individuals are purchased and sold by, among others, Bomis and Agrokomputer. Baltona and Pewex [dollar stores] import microcomputers (chiefly Atari) for dollars.

Minor hardware manufacturing projects include the production of a test lot of Ploter microprinters and so-called mice for computer graphics by the MERA-Poltik Precision Mechanisms Plants in Lodz, for the first time ever in any CEMA country. Another original project is the attempt to establish two assembling plants, one in Taiwan and the other in Singapore, undertaken by the Sykomat Shareholding Company in Krakow (which previously specialized in assembling PC/XT and AT clones from imported components; these two plants are to cooperate with a design office in Poland.

A separate problem, which can only be signalized here, is software. In this field the absence of organizational and legal measures is particularly keenly felt, because there is no shortage of software itself, copied (mostly illegally) from the highly developed countries, nor of good native programmers (Computer Studio Kajkowscy is particularly renowned).

Computers are finding direct application in Poland on a significant scale in branches of the ZUS [Social Security Administration] and LOT [Polish Airlines], as well as in banks and in the reservation systems of LOT and certain hotels, and wherever the art of word processing (30-percent saving of time, more or less), and preparing tables, comparisons, and catalogs (warehousing management, supplies, economic, financial, and personnel departments of enterprises), has been mastered. Lastly, computers are used for engineering-type calculations (so far chiefly at R&D institutes).

There are many examples of customized use of computers. Mention should be made here of the increasingly frequent and highly promising attempts to utilize computers in agriculture. The Exhibition on Microcomputers in Agriculture, held in Slupsk, illustrated the uses of microcomputers at four state farms as linked to the Voivodship Center for Agricultural Progress (WOPR) in Strzelin. A state-farm team from Tarnow Voivodship is attempting to introduce a computerized program for plantings and cattle raising, while the Bartoszyce WOPR reported that by using a computer in its farm advisory services it reduced to one-1,000th the time needed to prepare fertilizer-application recommendations.

Unfortunately, so far the use of computers in education is almost as customized, although a growing number of educational software program is appearing on the market. The ones designed for the littlest children teach by amusing, e.g. "Orthography" or "Mathematics."

Among the educational software in the form of games mention is deserved by "Alfabet ZOO" for the English language—it teaches writing and the names of the objects shown in drawings. For older pupils the National Publishing Agency has made available "The Quadratic Function" and "Calculus of Probability," which are suitable for classroom instruction and, if used at home, they operate as not only teaching but tutorial programs. Also commendable is game software that teaches thinking and deduction even though it is not directly linked to education as such. This includes the so-called logic games, such as checkers, chess, bridge, and tic-tac-toe.

In the very near future, at the latest after the Elwro 800 Junior computers are introduced in schools on a large scale, it will be necessary to coordinate the policy for disseminating such software and developing new software suited to the needs of various kinds of schools at various levels.

But the principal shortcoming of the Polish computer industry is the extremely slow development of the applications of computers in structural design and in the design of devices and equipment, that is, in a field in which work done by the traditional techniques, based on the use of a drawing board, takes months of even years, whereas using a computer linked to a plotter would reduce that time to minutes or at most an hour. The scarcity of so-called CAD (computer aided design) results in lack of flexibility (and hence also competitiveness) in those export fields in which intellectual thought counts most, i.e., in intricate equipment produced in short series and adapted to the wishes of the customer.

Telecommunications

On the interface between computers and automation there exists an entire domain of electronics as applied to telecommunications equipment. The Radom Telephone Plant is entirely prepared to manufacture the so-called electronic telephone, but the integrated circuits needed for this purpose are not as yet being manufactured on a large scale in Poland (three or four types of special LSI circuits are needed). Owing to the shortage of these circuits, the Radom plant, a significant exporter worldwide, is rapidly beginning to lose its markets.

Equally disturbing is the situation with telephone exchanges, although in this case the point is rather a too slow growth of the domestic network. At electromechanical telephone exchanges the installation of a single new telephone takes 10 hours of work in the manufacture of telephone equipment, whereas in the case of electronic exchanges it takes only 3 hours. Moreover, an electronic exchange takes up only one-third of the space of its electromechanical predecessor, consumes one-half the energy, and is 10 times more reliable. However, exploiting the present domestic potential for the production of electronic telephone exchanges would require 10 to 20 million medium- and large-scale integrated circuits annually.

Lately considerable hopes are being linked to optic fiber telecommunications, but here too 60-70 percent of the cost (and problems) is linked to microelectronics and semiconductor optoelectronics (light sources, detectors, amplifiers) which are not yet available in Poland for this purpose—aside from prototypes at institute laboratories. It is worth emphasizing, though, that the experimental optic-fiber telecommunications lines included (among the first in Europe) in normal operation within the Lublin and Lodz telephone systems are passing their test very satisfactorily.

Automation and Roboticization

In automation, a major domain of interest to Poland is electronic mining equipment. Some accomplishments have already been recorded in this domain. The pioneer was the Design and Mechanics Works of the Coal Industry in Gliwice (which built the world's first isotope-controlled automated extraction wall in the mid-1960s), later renamed the EMAG Mining Automation Corporation which developed a comprehensive extraction control system. Several other enterprises and laboratories are successfully operating in this field, but they base their operations mainly on imported electronic equipment (often in the form of private imports). We are not lagging far behind the world's leading edge as regards, particularly, equipment serving to improve mining safety. Here mention should be made principally of the anti-explosion and anti-methane systems (licenses sold to the PRC and Romania) as well as systems for early fire detection and systems for so-called wall communications.

As regards the automation of mining equipment EMAG has been cooperating with numerous foreign enterprises, which opened for Polish designers access to the microelectronics base of the highly developed countries. This is exemplified by the cooperation with the British Dowty Mining Equipment, Ltd. Especially worth noting among recent accomplishments of EMAG is a computer system

for the control of mine timbering, designed by Polish engineers. In the immediate future, the introduction of computerized control of the KGS-260 coal cutter-loader is also anticipated. If these experiments succeed, the lag separating us from such companies as Dowty or Siemens, which lead in the automation and electronicization of coal mining, a lag estimated at 2 or 3 years at present, will be markedly narrowed. Future plans envisage using laser equipment for automatic control of the KX-100 coal cutter-loader with a telescoping boom.

Abroad the principal field of automation is machine tools, production lines, machining centers. In this field the consistent line of development of modern industry is most clearly seen: from digital machine tools whose productivity may be as much as even fivefold the productivity of their classical predecessors, through flexible machining systems whose nature of production can be altered within several hours, to robotic "unattended" factories. In Poland only isolated efforts are as yet made in this direction: the Central Machine Tool Design Bureau in Pruszkow and the plants in Andrychow offer robotic machining clusters (copy milling machine, lathe, manipulator, and automatic stacker). A robotic welding cluster has been jointly developoed by MERA-Piap, OZAS in Opole, and OBR in Torun.

Last year 2,124 automated production lines (20 percent more than in 1986) operated in Polish industry and there were 408 machining centers compared with 351 in 1987. The number of robots operated in Poland at present is 233, compared with 171 in 1986. One more example, without stretching this list: while the number of manufacturing process control computers in the socialized sector totaled 487 in 1986, already in 1987 it climbed to 930.

An Achilles's heel in Poland is the digital control systems. The old generations of these systems, such as Numeroblock, Fotoster Nums, or Prus 720 and 730, were viewed by their makers as side products, while the new generations based on microprocessor systems and equipped with monitors still exist in the laboratory stage, although their production on a small scale at WAREL Plants is anticipated.

Following several years of stagnation, the production of industrial robots in Poland is reviving. An updated version of the old licensed Swedish robot made by the ASEA Company and currently called 1Rp is going to be produced by MERA-Zap Plant in Ostrow Wielkopolski in cooperation with the Poznan H. Cegielski Plant, as well as by the Spomasz Food Processing Machinery Plant in Bydgoszcz in cooperation with the Iskra Plant in Kielce and the PONAR-Bipron Plant in Zabrze. By the end of this year an information series of these machines should be prepared. The related agreement specifies robots with lifting strengths of 6.6 and 90 kilograms, with electrical drive and thyristor motors. These robots will operate as all-purpose means for the automation of production technologies, and primarily of the processes

that are difficult or arduous to master by man. Certain plants and plant design offices have begun to conceive and build robots on their own for their own needs. Entire workstations and peripheral equipment have begun to be produced. TECHMA-Robot and the Institute for Industrial Automation also want to assemble 1Rp robots. If we include the robots built at still other plants by the "cottage-industry" method, we should have annually as many as 1,000 new Polish robots together with peripheral devices.

A major item of professional electronic equipment is measuring devices (including nearly the entire output of POLON), Lublin scales, electronic devices for measuring geometrical quantities—e.g. electronic slide calipers and supersensitive altimeters—and a computer-coupled chartmeter developed by the Industrial Optics Center. On the other hand, the production of electronic meters, temperature governors, etc, that is of a huge variety of devices helping so effectively the highly developed countries to enforce conservation of energy, fuel, water, etc, is developing too slowly or not at all.

Given the existing production possibilities, aother "electronic road" toward energy conservation looks somewhat better, namely, the application of thyristor systems to power drives, which serves at once to reduce electricity consumption by 10-15 percent.

Transportation, Protection of Property and Environment

Of major worldwide importance is the application of electronics to motor vehicles. It has not yet appeared in Poland, unfortunately—if we except the dashboard—but numerous design projects, especially those conducted at the Bielsk-Biala FSM and at university research institutes, point to rapid developments in this field. The situation is much better with the application of electronics to railroad traction (power savings), especially as regards assuring safer train traffic.

The quantities of semiconductor devices and integrated circuits needed by the aviation and shipyard industries are relatively small, but they have to be highly specialized. Unfortunately, these kinds of devices are among the most scarce, owing to their extremely difficult technology and the total embargo on their export in the capitalist countries. Recently the FAMOR Marine Equipment Works in Bydgoszcz has begun to specialize in manufacturing electronic equipment for shipyards; it is offering, among other things, equipment for automating power generating facilities, engine remote control systems, and marine power plant control systems.

An extremely widespread (chiefly owing to small craft shops) application of "consumer electronics" is in the form of various electronic systems protecting against home and car burglaries. Similar devices, though one-of-a-kind and custom-designed, serve as protection

against natural disasters and burglaries at museums, especially at the poorly secured ones that contain invaluable treasures of church culture.

An example of a good solution may be provided by the so called Discrete Alarm System (SDA) recently developed at the Krakow Mining and Metallurgical Academy. The SDA consists of two parts. A sensor (a little red box) is installed in the safeguarded object and connected to a telephone. It reacts to uninvited guests as well as to water and high temperatures. If it detects danger, it automatically alerts the other part of the SDA, i.e., the terminal, via the telephone cable. That terminal is a computer linked to a monitor, a printer, and a signaler and installed in the office of the duty officer at the Krakow WUSW [Voivodship Internal Affairs Office].

In the event of an alarm the monitor screen at once displays information on the object in which something bad is happening. The quantity of information depends on what had previously been encoded on this subject in the computer. The screen will display site of event, access routes, and eventual obstacles (street excavations, etc), because that information is continually updated in the computer. The duty officer provided with that information may dispatch the nearest militia patrol to the endangered object. If the need arises, he alerts the duty officer at the firehouse, who commences a rescue operation.

The system operates on very simple principles. But questions arise. What happens if, for example, the telephone line to which the sensor is connected becomes damaged? In this event the sensor can independently select another, operational line. If, however, all the accessible communications lines are damaged, the sensor contacts the terminal via radio. It is possible to secure, e.g. an apartment building containing one telephone. The SDA is designed to provide effective alarm protection for 60 tenants provided with sensors.

Similarly broad and perhaps even more important is environmental protection. In particular, there is a chance for the related control and measuring devices to become a Polish specialty. Recently, highly interesting devices were displayed at several international exhibitions by the ELWRO Wroclaw Works and their affiliated Institute of Computer Systems, Automation, and Measurements. The new Polish offer includes, among other things, a microcomputer-equipped analyzer station for monitoring water pollution and detecting the content of heavy metals in water, and mobile laboratories for monitoring water quality and farmland contamination. Also exhibited were sets of devices, sensors, and computer networks enabling a central office to obtain information on water impurities appearing in any part of the area monitored. This system can be extended, for example, to an entire river basin.

On the boundary line between problems of environmental protection and energy conservation there is equipment of the "electronic burner" type, manufactured by the Bumar-Warynski Works in Torun. It has been described as follows by a journalist: "The 'electronic burner' serves to save as much as 20 percent of coal dust. Moreover, this most up-to-date 'burner' displays many other advantages: it is cheap to operate, it works day and night, and it does not drink, is not late for work, and does not get sick. By constantly monitoring the desired temperature in hothouses, mushroom caves, etc, it serves to increase harvests."

Medicine

Medical electronics enterprises are extremely differentiated and scattered, and most often they are experimental plants (the best-known is TECHPAN, which specializes in ultrasonic equipment), discrete laboratories at institutions of higher education, and even small craft workshops. Their products are mostly original, protected by Polish patents. Latest examples of such products include the TECHPAN-developed ultrasonic pulse detector, the SOPAN-developed ultrasonic blood flow detector, a Tomel-developed cardiac monitor, a Famed-developed artificial kidney linked to a computer (in the prototype stage), and many others. Such products are often manufactured in cooperation with internationally well-known companies, such as Siemens, General Electric, etc.

The SP-5 non-esophageal cardiac stimulator has elicted considerable domestic—it received several awards—and world interest. Three such stimulators are currently used at leading electrophysiological centers in the United States. Recently a contract for the sale of the first 150 stimulators to the United States has been signed. Interest in this device was also expressed by France, Spain and Italy. More and more purchase bids are coming in.

Forecasts

The spread of electronics in Poland follows two roads. The first is the attempts to acquire the indispensable base of microelectronic subassemblies by means of imports, which can be private imports (integrated circuits brought in by tourists or by Polonia firms), barter imports (in exchange for equipment or other integrated circuits), or coproduction imports (links with foreign enterprises making their own integrated circuits). The second road is through establishing an indigenous Polish industry. The optimal approach is through an astute combination of both roads: electronic equipment industry should import the integrated circuits which will subsequently be manufactured by an indigenous electronics industry. Small quantities of imported integrated circuits should be utilized to develop prototypes of new products, so that, once the series manufacture of these products is commenced, they could be assembled from

the concomitantly developed and domestically series-manufactured integrated circuits (or circuits acquired from countries with which specialized barter trade is under way).

The development of an indigenous microelectronics industry, preceded by a corresponding development of the semiconductor materials industry (polysilicon, silicon, gallium arsenide, etc, but also auxiliary materials, particularly those which already constitute a Polish specialty, such as polishing cloths, pastes, etc) and microelectronic equipment (here the Polish specialty could be assembling equipment, diffusion furnaces, testers of semiconductor materials) must be based on the international [CEMA] division of labor and specialization. The directions in which Poland still continues to lead the CEMA countries should be rapidly developed; this means chiefly digital and microprocessor systems in C-MOS technology, auxiliary bipolar microprocessor systems, and eventually systems which could become a Polish specialty, such as C-MOS memories, telephone systems, and certain special-purpose systems. It will not be possible either to avoid manufacturing certain semiconductor devices designed chiefly for domestic needs, including microwave and optoelectronic devices, thyristors, thermistors, etc.

During the initial period, at the latest by the end of the 1980s, it is necessary to focus on providing the market with the largest possible number of elementary microprocessor systems, e.g. of the MCY 7880 type (and subsequently 16-bit ones) and memory chips, though 16-kilobyte ones (subsequently 64-kilobyte ones).

With regard to the uses of electronics itself, absolute priority should be given to the automation (and only afterward to roboticization) of production processes in industry, to be followed by the application of electronics to finished products, especially the exportable ones (e.g. mining and electromedical equipment, telephones). The third priority should be the computerization of office work and the mass introduction of microcomputers (personal and home computers) in every domain where they can be of use. In view of the attractiveness of this kind of activity, the focus should be on the mass production of good and low-cost computers, and their applications should be left to the inventiveness of individual users. This does not mean in the least abandoning other uses of electronics, such as roboticization (especially the introduction of electronic manipulators), large computers or computer networks, and electronic articles of common use and household appliances. Given the conditions in Poland, these three directions of action are an absolute necessity and a majority of the available resources and social attention should be devoted to them.

The outlays on developing the applications of electronics are everywhere very high. Broadly conceived applications of electronics (from materials for microelectronics to robotization) absorb in highly developed countries about one-half of all resources spent on technical progress, and the pattern is such that the more sophisticated technologically a country is the greater part of these resources is spent on the base and the smaller part on final equipment. According to various sources, in the United States, for example, the outlays on developing the applications of electronics account for about 50 percent of all R&D outlays in general, and the outlays on microelectronics (inclusive of materials and equipment for microelectronics) account for about 80 percent of the outlays on electronic applications.

Utilizing such huge outlays requires pursuing a specific development policy, which is particularly difficult to "balance" in small and medium-sized countries, including Poland.

It has to be borne in mind that there exists a feedback between the development of electronics and the level of a country's general technological culture.

A specific feature of Poland's situation is the need for:

—an extraordinary acceleration of the development of the microelectronic base (Poland began to regress rapidly during 1980-1987 compared with its partners, who have accelerated markedly, and we need, more than in the other countries, an increase in labor productivity);

—changes in the organization of the science serving microelectronics and the spread of electronics (by contrast with other domains of technology, in microelectronics industry is already cooperating well with scientific institutions, but in science there still exists considerable potential that should be tapped);

—integration of various domains of technology and selection of appropriate specializations;

—integration of the efforts of CEMA countries to attain independence from suppliers practicing various forms of discrimination (embargo).

Within the next 5 to 7 years Poland will be markedly constrained by the absence of its own microelectronics base. The existing base will suffice for only a very few enteprises which even now are commencing the production of electronic equipment, as well as for experimental centers. During that period the following problems will be most tangible:

—difficulties in importing integrated circuits, which at present are in short supply in all CEMA countries and can be acquired—and this situation will persist for at least 5 more years—only throough barter for other integrated circuits;

—uneven application of electronics to the least effective fields, owing to the availability of only those integrated circuits which are no longer needed by other countries;

—underestimation and underdevelopment of automation, due to the shortage of integrated circuits and psychological resistance by the older generation of managers, engineers, and technicians;

—overestimation of the development of the "assembling" branches linked to the applications of electronics, inclusive of computer assembling, because the increase of 15 or so percent in the productivity of these branches compared with the extremely slow growth of other producers will prompt us to forget that abroad they are developing much more rapidly.

In conclusion, it should be emphasized that Poland still has a chance to join the group of countries for which the technology revolution will become the prime mover of development.

GDR's MZOS 'Convolver' Proves its Versatility in Signal Processing
23020048 East Berlin RADIO FERNSEHEN ELEKTRONIK in German No 1, 1989 pp 18-19

[Report from the Physics and Technology of Electronic Components Section, Ilmenau Technical Institute, by Bert Wall, PhD, Armin Urban, MS. Engr, Heidrun Neise, MS. Engr. and Prof Werner Buf, PhD: "MZOS Convolver for Rapid Analog Signal Processing"]

[Text] The correlation or convolution of signals at high frequencies in real time can only be undertaken digitally at very high cost, but with acoustic convolvers very easily analogically. MZOS convolvers are superfast signal processors that work with surface acoustic waves, and they will be presented in this contribution.

The object of these considerations will be the MZOS convolver which has a layer sequence of metallic zinc oxide-silicon dioxide on a silicon substrate. In previous publications (1) (2) (3), the multitude of application possibilities of components working with surface acoustic waves has already been demonstrated and it has been indicated that components such as the MZOS convolver, which work with surface acoustic waves, can be used to realize complex signal processing functions.

Application Possibilities

With the help of acoustic convolvers it is possible to fold or correlate (4) two HF signals chosen at random in form and frequency. Their advantages vis-a-vis corresponding digital signal processors lie in higher processing speed, smaller volume and lower power drain. For example, a convolver working with surface acoustic waves with a bandwidth of 200 MHz and a recovery time of 10 µs, corresponding to a theoretical calculating speed of 8 . 1010 arithmetic operations per second, has a power consumption of only a few watts (5).

The complex mode of operation opens up a broad field of application possibilities for the convolver. It is primarily utilized as a programmable matched filter in interference-protected communications transmission systems with band-spread technology, the so-called spread-spectrum systems. These systems are used in aircraft and satellite communications, among others, since they need to work with a multitude of signals for reasons of protection against interference and interception. An additional application for the convolver is direction-finding for objects. Here, its high processing speed plays a significant role, since the direction-finding systems used in radar and traffic engineering must process the data in real-time.

Convolvers can also work favorably in image-processing systems.

Three-dimensional image processing in combination with robot technology is gaining increasing importance. Convolvers can be used here for object recognition in a three-dimensional space (6).

In recent years correlation measurement technology has experienced tremendous development. Additional application possibilities result in this field for the convolver. It is conceivable, for example, that measurements of surface roughness, determination of the weighting function of linear measurement objects and speed measurements with the help of the convolver can be undertaken.

Functions of the Passive MZOS Convolver

Convolution or correlation of two signals means that these signals are shifted against each other, while the degree of compatibility of these signals is continuously determined. In convolution only one of the two signals is inverted in time with respect to the correlation.

The convolution or correlation of signals is thus achieved through time delay of the signals, multiplication (blending) of the signals and integration of the mixed products. These partial functions can be carried out relatively easily with AOW [not further identified] components.

With the MZOS convolver (Figure 1) these partial functions take place as follows: MZOS stands for the layer system Metal, Zinc oxide, Oxide, Semiconductor, in which silicon is used as a semiconductor. The ZnO layer belonging to the system has piezoelectric properties, which enables a buildup of interdigital transducers and thus excitation of surface acoustic waves on the non-piezoelectric substrate. In so doing a dependent relationship between the buildup of the interdigital transducer and the ZnO layer thickness and the wavelength of the surface acoustic wave to be excited must be adhered to, in order to produce the highest defined electromechanical coupling factor possible. Applied electrical signals, whose frequency is in the vicinity of the resonant frequency, are transformed by the interdigital transducer
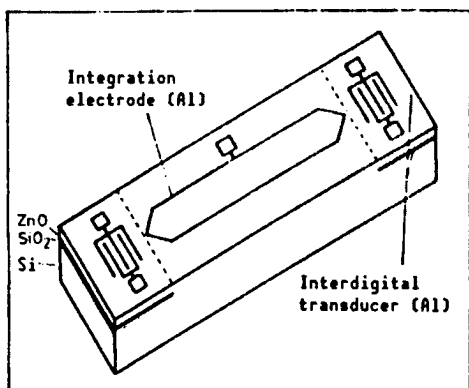
Figure 1: Passive MZOS convolver.

into surface acoustic waves. The synchronism frequency is determined by the speed of the surface acoustic waves and by the wavelength of the surface acoustic wave at this frequency, which corresponds to the distance of two neighboring fingers of a transducer comb.

The speed of the surface acoustic wave is about five orders of magnitude lower than the electromagnetic waves in vacuum. For this reason time delays can be achieved in the input signals in the range of microseconds.

A pure mode direction is chosen as propagation direction. The portion of the wave which spreads backward in the direction of the chip edge is absorbed through a damping mass applied there. The portions of the surface acoustic wave spreading in the direction of the middle of the chip overlay in the area of the integration electrode.

A surface acoustic wave in a layered system, in the area of the integration electrode, is shown in Figure 2.
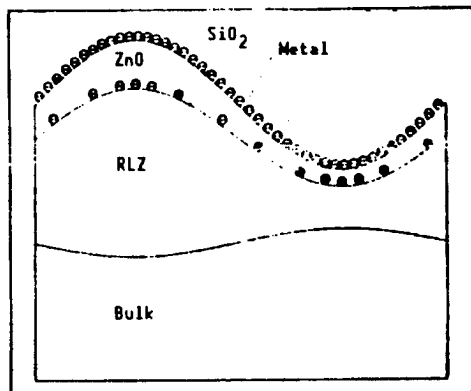
Figure 2: Surface Acoustic Waves om MZOS Layer System.

The integration electrode is put under bias voltage against the bulk in such a way that the surface of the semiconductor under the integration electrode becomes depleted of charge carriers. The bias voltage is applied through a low-pass filter, so that the convolution signal anticipated at the integration electrode will not be shorted out by the operating current. The surface acoustic wave, which is expressed as a distortion of the surface and thus in the ZnO layer as well, is accompanied by an electric field. This field gets overlaid onto the continuous field produced by the bias voltage, which results in a spatial periodic change in the electric field intensity and thus, correspondingly, in a spatial change in the thickness of the space charge region.

In the depletion region the electric field intensity at the surface of the semiconductor is linearly dependent on the density of space charge region I. An integration over it results in the surface potential φs

$$\varphi s = \frac{-qN_D I^2}{2\varepsilon_{Si}} = \frac{-\varepsilon_{Si} Es^2}{2qN_D} \qquad (1)$$

for which

Es is the electric field intensity at the surface of the semiconductor,

N_D the dopant concentration,

q an integral multiple of the elementary electronic charge and

ε_{Si} the dielectric constant of the silicon.

Equation 1 shows the quadratic relationship between electric field strength at the silicon surface and the surface potential. At this non-linearity two surface acoustic waves, which are superimposed in the area of the integration electrode, are mixed. Thus, an additional condition for convolution or correlating input signals is given.

Integration of the mixed products takes place over insulator capacity through the metallization of the surface, meaning the integration electrode.

If at the two interdigital transducers the HF signals were laid down, from whose envelope the convolution or correlation function is needed, the result at the integration electrode is the convolution or correlation of the input signals, but compressed in time by a factor of two, and with double the frequency of the carrier frequency of the input signals. This can be traced to the relative speed of the surface acoustic waves to each other, which is twice as great as the phase speed of the waves in the layer system.

Figure 3 [not reproduced] shows the convolution of two 4-μs-long, 100-MHZ-modulated rectangular signals by means of a passive MZOS convolver.
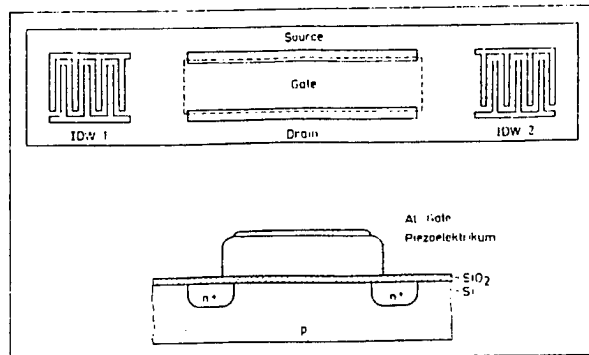
Figure 4: MZOS-FET Convolver.

MZOS-FET Convolvers

MZOS convolvers can work not only passively but actively as well. With an active convolver either the surface acoustic wave as an information carrier or, as with the MZOS field effect transistor convolver (MZOS-FET convolver), the mixed product of the input signals becomes reinforced. The MZOS-FET convolver (Figure 4) consists of the same layer sequence as the already described passive convolver. The conversion of the electrical input signals into surface acoustic waves also takes place by means of two interdigital transducers. The waves propagating in the layer system influence the time delay necessary for convolution. In order to realize the partial functions of multiplication and integration, effects other than those for the passive MZOS convolver are utilized.

In the transistor region, the signal interaction space, the waves become superimposed. Since a piezoelectric layer (ZnO) exists in the gate space of the field effect transistor, the distortion by the surface acoustic wave results in production of an electric current corresponding to the wave signal. This voltage, which, along the gate, represents an image of the superposition of the waves, affects the channel area of the field effect transistor. If the operating point of the transistor is chosen to that it is located in the saturation region, the drain current of the transistor is influenced through the induced gate voltage at each point x according to the correlation well-known for the MISFET

$$I_D = \frac{\mu_{eff} C_{ox}' w (U_{GS} - U_T)}{2L} \qquad (2)$$

where

I_D = drain current,

μ_{eff} = effective charge carrier mobility,

C_{ox}' = surface-related oxide capacity,

w = channel width,

L = channel length,

U_{GS} = gate current.
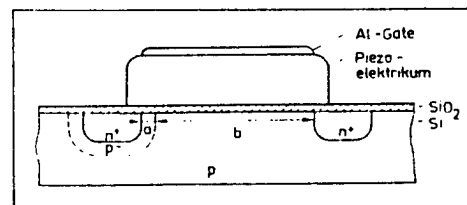
Figure 5: DMOST Convolver.

With equation 2, the quadratic correlation between gate current and drain current becomes clear. Through this non-linearity the superimposed input signals are multiplied. In the highly doped and therefore low-impedance drain area the result is an adding-up and thus an integration of the partial drain currents. Consequently, all partial functions necessary for convolution or correlation, respectively, are present.

The advantages of the field effect transistor convolver as compared with the passive convolver consist primarily in the greater values of convolver effectiveness that can be achieved and thus the output signal. This is balanced as disadvantages by a complicated production technology and a narrowed bandwidth which ultimately can be attributed to parasitic capacities.

The use of DMOS transistors (double-diffused MOSFET) in (7) has an advantageous effect on the properties of the FET convolver. Figure 5 shows that the channel is divided into two areas. With suitable determination of the technological parameters and the operating point (short-channel operation), only the short channel area (a) determines the flow of current through the transistor. Channel area (b) is a pure drift field. The DMOS transistor therefore possesses all the advantages of short-channel transistors, but not their disadvantages, such as the punch through of a limited operting area. Among the advantages are the great transconductance of the transistor as well as stronger non-linearities. Both have the effect of higher convolver effectiveness.

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NUCLEAR ENGINEERING

Polish Chemist Outlines Procedure, Results of Fusion Experiment
51003003 Warsaw POLITYKA in Polish
No 15, 15 Apr 89 p 10

[Interview with Dr Engineer Jerzy Zak, 1968 graduate of the Technical University of Silesia in Gliwice, postgraduate work at the Technical University of Warsaw while employed in industry; since 1970, employee of the Section of Chemical Physics at the Institute of Inorganic Chemistry and Technology headed by Prof Dr Jerzy Strojek; in 1981 through 1983, visiting scientist at the Ohio State University (U.S.), by Jan Dziadul: "A Ridiculously Simple Experiment"; date and place not given]

[Text][POLITYKA] Doctor, I will admit that I came here with a dose of skepticism. For about 40 years now, the largest laboratories of the world have been spending billions in order to harness nuclear energy; thousands of scientists have unsuccessfully tried to perform controlled nuclear fusion. On the other hand, electrical chemistry specialists Martin Fleischman from Southampton University in Great Britain and Stanley Pons from the Utah University in the U.S., who were the first to conduct the pioneering experiment, announced that they had carried it out in a ridiculously simple manner. You have already managed to say that an average chemistry student is capable of performing this experiment. The impossible suddenly became possible! Is this to say that the avenues of search to date have been erroneous? Is it still possible that solutions of epoch-making significance for mankind would "hide" in incredibly simple arrangements?

[Zak] As recently as several weeks ago, nobody believed that such an experiment was at all possible! I would have scoffed at anybody who would have suggested that controlled nuclear fusion can be performed at room temperature, using a small sample. Relevant research is performed in giant installations called tokamaks in which temperatures several million degrees high are obtained, and an attempt is made to keep them so for millionth fractions of a second. Issues of this nature used to be the domain of nuclear physics; nobody could get it through his head that performing controlled fusion was possible outside this field of science. Only one avenue of research existed. When I heard a radio report before the holidays I was sort of interested in this unusual event, but not enough to get excited. This was not my field of research. I know about nuclear physics in conjunction with academic training. However, I admit that later, when I read a report in FINANCIAL TIMES on the authors of the epoch-making discovery, electrical chemistry specialists of world renown, my surprise was boundless. Could it be that the key to cheap energy is in our pockets? On the other hand, authorities such as Fleischman and Pons do not lend their names to dubious solutions...

[POLITYKA] Excuse me, doctor, but is this to say that, if everything is so banally simple as the discoverers have evaluated, you and other electrical chemists have been going in circles every day around a sensational achievement but there was no... What I mean exactly is, what wasn't there?

[Zak] There was no fantastic thought violating the rules of the game to date! Some argue that this was chance. The authors have said that their work had lasted for more than 5 years, but they had treated their unlikely assumption rather as a hobby, without much confidence in success. They have covered the outlay for the experiment with their own funds, so we can surmise that they were doing it quietly. Were the others not far behind? I am convinced, since the time the experiment of Fleischman and Pons was replicated, that many scientists have thought about an unknown source of energy which appears in research of this kind. However, they passed it over. This was nothing important, or nothing that interfered with experiments in a major way. One needed truly fantastic imagination in order to link this phenomenon with a nuclear reaction.

[POLITYKA] For pointing the way, and this is how we may perhaps define the first experiment by the American-British team, they deserve a Nobel prize. However, what do you mean by saying that this was accomplished "in a ridiculously simple manner?"

[Zak] As briefly as possible, the essence of nuclear reaction consists of combining light atomic nuclei into atomic nuclei with a greater mass. A considerable amount of energy is then released. Here I would once again like to make the reservation that I am explaining

issues not associated with my field of interest. Thus far, the difficulty has been that more energy was expended than obtained. Also, a reliable method of controlling fusion could not be found.

[POLITYKA] This is how FINANCIAL TIMES wrote about this sensational experiment: "The two scientists have used electrochemical methods in order to acheive the fusion of deuterium embedded in a palladium electrode, a metal similar to platinum."

[Zak] This very statement prompted me to replicate, or check out, the experiment. Palladium is a commonly used catalyst with the help of which certain energy barriers are overcome. It is also known that it dissolves hydrogen best when it is used as an electrode in experiments. Another name for that is hydrogen absorption. One unit of palladium "absorbs" about 800 units of hydrogen in volume. A compression of sorts of the hydrogen occurs, and as we now know, nuclear fusion takes place at the time. It is also important that at room temperature hydrogen is split from elemental to atomic. If there were no catalyst (palladium), temperatures of a dozen or so million degrees would be needed for such a reaction. This is the case in experiments conducted in a pure water environment, and there is nothing unusual about this. Stanley Pons and Martin Fleischman used heavy water rather than usual water, and received deuterium, or an isotopic variety of hydrogen, as a result of electrolysis.

[POLITYKA] Was your experiment a faithful copy of the original one?

[Zak] Yes, perhaps yes, because I do not know all the details yet. I thought about this throughout the holidays. I had everything needed for the research except heavy water. Under normal conditions, it should be ordered from Swierk, but I was in a great hurry... It is hard to even describe the feeling of wanting to be around what is an epoch-making event at the very least. On Tuesday after the holidays, I succeeded in getting a small amount of heavy water, and I embarked on the experiment immediately. This took perhaps half an hour; in subsequent days, I repeated the research...

[POLITYKA] I apologize for a request thus put, but could you describe in an easy-to-understand manner the event which may change our civilization?

[Zak] During the electrolysis of heavy water on a palladium electrode, the deuterium which has penetrated the crystal structure of metal was given off. After saturation, small bubbles appeared on the surface of palladium. Therefore, the experiment conducted under electric current, in a sense, resembled charging a battery because after the charging is complete the energy expended may be retrieved by using this system as a source of current. In the reverse process, that of retrieval, gaseous deuterium is transformed into ions soluble in the heavy water. As it turns out, the reaction is accompanied by the fusion

of deuterium nuclei in palladium, without which the entire process would require colossal temperatures comparable to reactions taking place on the Sun.

[POLITYKA] Therefore, nuclear fusion occurs in palladium! Why exactly in palladium?

[Zak] With some reservations, we might say that this is exactly the essence of the revelation; however, we do not know absolutely why it happens this way. It is known that palladium accumulates energy, but it is not known why! This is exactly what's fantastic and... unexplained!

[POLITYKA] Fleischman and Pons do not know this either?

[Zak] I do not believe so. However, it is certain that without solving this problem we cannot dream about a new era in power generation.

[POLITYKA] What is the, so to speak, "tangible" proof that nuclear fusion has occurred?

[Zak] The process is accompanied by the diffusion of free neutrons and tritium, or typical by-products of nuclear fusion. I also registered radiation. In the process of "discharging" the palladium we secure greater energy effects than those previously expanded for saturating it with deuterium. This can be called flameless combustion!

[POLITYKA] How much more energy do we receive? Isn't it perhaps the most significant point in the entire issue of controlled nuclear fusion?

[Zak] Every experiment produces a different result. In my case, these were amounts 2 to 3 times greater. Reportedly, Fleischman and Pons have received even more favorable results. This may not be too much, but we are only at the beginning of a long road.

[POLITYKA] What will happen when we are at its end? When will that happen?

[Zak] We will obtain an altogether unimaginable source of inexpensive and clean energy. The authors of the discovery are apparently talking about a period of 20 years. Personally, I am an optimist, as I am aware of, say, the American determination in searching for non-conventional energy sources after the 1974 crisis. This should come about sooner. The prospects may be visualized with the following examples: in a cubic meter of water (1,000 liters) there are about 30 milliliters of heavy water. In one kilogram of regular water there is so much of this fuel that the energy generated in the process of nuclear fusion may replace 350 liters of gasoline.

[POLITYKA] However, producing heavy water is also very costly!

[Zak] Correct. However, thus far the need for it has been met, and, therefore, in principle cheaper methods of producing it were not sought. Theoretical approaches have already been worked out, so I do not see a problem here. There may be some problems only with the radiation. However, they should not be any greater than in the case of fission of the nuclei of heavy elements with nuclear energy.

[POLITYKA] Do you see in this sensational discovery any temptation for the military complexes?

[Zak] Fortunately, I do not, except in the sense that the energy so generated may be used for various purposes. However, in this instance an explosion is unlikely. This process is naturally controlled; its rate is restricted by many physical and chemical phenomena which are difficult to even discuss now. At this time, I may note that the process is too controlled to attempt generating the desirable amount of energy.

[POLITYKA] As a specialist in electrical chemistry, do you think that the nuclear physicists have been humbled in a sense?

[Zak] No, I don't. I think they have only been astonished. I have also encountered disbelief on their part. However, I believe that we should work on this issue together; the research of nuclear fusion should be interdisciplinary. After all, they have an experience of several decades which we lack.

[POLITYKA] What niche do you see for yourself in future research involving this problem?

[Zak] Several weeks ago, I submitted a research program covering other topics. However, it would be logical for me to get involved in the work on nuclear fusion, but this does not depend on me anymore. In any event, money for such research should be found immediately. In the U.S., the Department of Energy has stated its willingness to fund such work. Several successful experiments with nuclear fusion have been already performed in Poland. Therefore, at this moment we are among world leaders.

[POLITYKA] Just as we were years ago with optical wave-guides?

[Zak] It would be a pity to waste yet another chance!

[POLITYKA] We congratulate you on your success, even if it is just a replication of the experiment. Thank you for the interview.
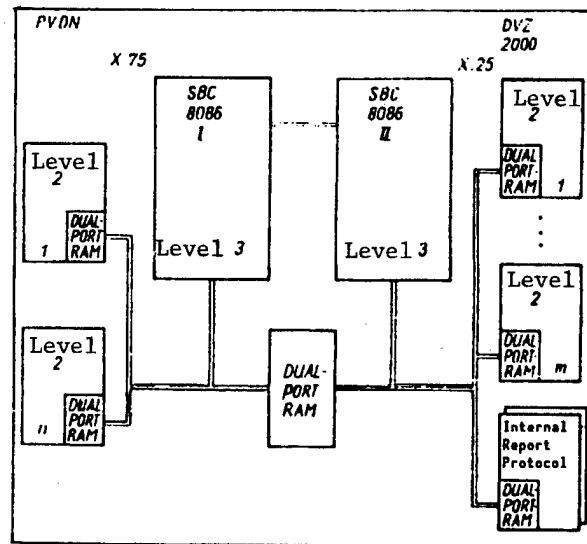
Figure 1. Principle Circuitry Plan for the Packet Communication Module.

TELECOMMUNICATIONS

GDR's ISDN Packet Switching Module Described

23020053 East Berlin NACHRICHTENTECHNIK-ELEKTRONIK in German No 1, 1989 pp 6-7

[Article by graduate engineer Steffen Rommeck and doctor of engineering Horst Kolloschie of Dresden Polytechnic Institute, Department of Information Technology: "Coupling Data Networks"]

[Text] The packet communications module (PCM) serves to connect the data network developing in the GDR, which is secured by means of packets (PVDN) with a future ISDN, which is envisioned as a module for the ISDN-compatible communications central, DPC.

The modular structure of the PCM makes flexible use possible, not only within the context of the data processing central, but also as a packet nexus in a packet network, or in the ISDN. Based on the projected transformation to higher bit rates (48 or 64 kbit/s), and the possibility of adding several virtual connections by means of an X.25 interface, the result could be an increase of traffic handled by the PCM. As a result of the PCM's modular construction, it is possible to adapt the latter to the projected volume of traffic, and to vary the number of channels in keeping with the flow rate and the required packet lingering period.

The picture of the modular mimic display (Figure 1) shows the basic structure of the PCM. It is a two-computer system that is expanded in modular fashion by the addition of intelligent peripherals. This configuration was selected, on the one hand to achieve a strict
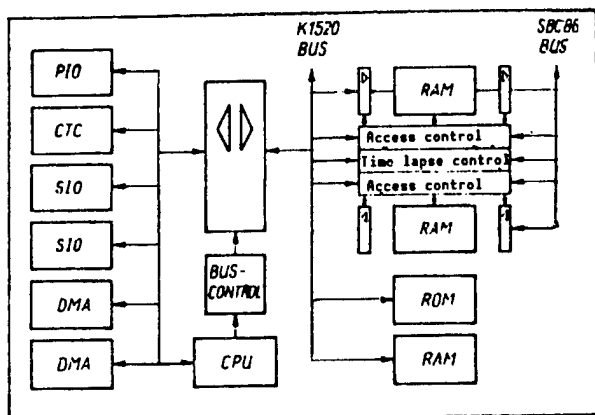
Figure 2. Universal Link Controller.

separation of the individual levels of the OSI reference model, and on the other hand, to make a division of the processing of the various protocols (X.25 in the direction of DPC or X.75 in the direction of the PVDNs in the GDR), possible.

For third-level processing of the protocols, there are two 16-bit OEM Computers SBC 8086 (single board computer 18086) based on the K 1810 WM 86, which communicate with the aid of a dual port memory [1]. For operating and testing the hardware of the SBC 8086, an EPROM expansion card with two program- addressable free memory banks, as well as an indicator unit for bus signals were created. For communication in conjunction with software development or testing, the SBC 8086 has corresponding parallel and serial interfaces. In this way, interfacing with an office computer BC 5120.16, with a personal computer, MZ 80/B, as well as with a developmental system P 8000, including the appropriate software, can be realized. Thus, in addition to external methods of storage (such as floppy disks or magnetic tape), the keyboard and the screen of these computers can be used for interactive work with the SBC 8086.

For connecting the PCM to the DPC, or to the GDR's PVDN, there are universal link controllers (ULC's)—working independently of each other—that are based on a rapid U 880 system (clock frequency 4 MHz). In the direction of the DPC, 60 64-kbit/s channels (2 PCM-30 tracts) should be realized. The second level processing of the X.25 protocol of these channels is accomplished in its entirety in the ULC. In the direction of the PVDN, ULC's are also used to process the second level of the procedure X.75. The packets, which were freed of the level 2 operational information, are taken over with the aid of dual port-dual page storage systems, which are present on every ULC.

The area in which the ULC is primarily used is working out all functions necessary for establishing, maintaining, and dismantling the connection. The flexible computer

solution can also perform other functions, such as working out the internal report protocol or controlling the channel commutator on the DPC. The ULC, whose principal switching plan is shown in Figure 2, contains the following component groups:

- CPU UA880, to the unbuffered bus of which, all peripheral interception circuits are connected (2 SIO, 2 DMA, CTC, PIO)
- Bus driver, including corresponding control switches
- Memory block with RAM or EPROM circuits (there are 7 sockets for EPROMs U2716/U2732 or RAMs U6116; in addition, external memory modules from the ULC can be used via the K 1520 bus).

A dual port/dual page memory having the following characteristics is used to tie into the SBC 8086:

- Potential use of the ULC as a passive memory card in K 1520 systems as a link to an SBC 8086;
- Block commands can also be used on the part of the SBC 8086;
- The dual page principle makes a separation of the data writing and data reading functions possible. As a result, fewer instances of internal blocking occur, and data transfer occurs more rapidly.

Thus, instances of extended access in conflicts in worst-case scenarios—e.g. block commands on the part of both processors—occur only 7 percent of the time; 10 percent in the case of the SBC 8086. For both 4-kbyte storage sections in each direction, 2 access controls and a shared time-lapse control have been developed. The dual port/dual page memory also causes the adaptation of the 8-bit data base of the UA 880 to the 16-bit data bus of the SBC 8086. The resulting word access on the part of the SBC 8086 doubles the transfer rate. In this way, the packet transfer from the ULC to the dual port coupling memory and vice versa requires only 6 percent of the processing capacity of an SBC 8086.

The ULC's software includes the operating system (initializing the peripherals, memory test, among others), as well as the program module for level 2 processing. The latter is present in assembler language and in CHILL. Beyond that, it is possible to implement special software, e.g. language packets, or alternative software, e.g. channel commutator control software.

As a result of its flexible hardware and software structure, the universal link control can be adapted to a wide variety of applications. The structural identity of all controllers makes a dynamic, program-directed change of its function possible, which results in a meaningful increase of the reliability of the PKM. To increase effectiveness in programming levels 2 and 3 of protocols X.25 or X.75, higher program languages (particularly CHILL) are being used when possible. Corresponding

SDL graphs, among other things, serve this purpose. An office computer, BC 5120.16 and a P8000 with the operating systems UDOS and WEGA serve as software development systems. Time-critical or hardware-related software modules are realized in U880 or 8086 assemblers.

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